



Government of Kerala

Abstract

Local Self Government Department- Report of the Committee constituted for evaluating indigenous technologies and selected other technologies for waste management in households/ residential colonies/ schools - Approved - Orders issued.

LOCAL SELF GOVERNMENT (DC) DEPARTMENT

G.O.(Rt)No. 718/2012/LSGD. Dated, Thiruvananthapuram, 9.3.2012.

- Read:- 1. Proceeding No.SM/C2/2749/11 dated 18/10/2011 of the Chairman, Suchitwa Mission and Principal Secretary, LSGD.
2. Letter No. SM/C2/2749/11 dated 23.2.2012 from the Executive Director, Suchitwa Mission, Thiruvananthapuram.

ORDER

A Committee has been constituted for evaluating indigenous technologies and selected other technologies for waste management in households, apartment complexes, residential colonies, schools, etc., under the leadership of Dr.R.V.G.Menon as per the proceedings 1st read above. The Executive Director, Suchitwa Mission as per the letter read as second paper has submitted the report prepared after screening, discussion during presentation, physical verification and further clarifications by the Committee and requested for its approval by Government

After having examined the report in detail Government are pleased to approve the same which facilitate the efforts of Government in the decentralization process of waste management, as appended to this order.

BY ORDER OF THE GOVERNOR
JAMES VARGHESE,
PRINCIPAL SECRETARY

To

The Executive Director, Suchitwa Mission, Thiruvananthapuram.
The Principal Accountant General (Audit), Kerala, Thiruvananthapuram.
The Accountant General (A&E)/(LBA&A), Kerala, Thiruvananthapuram
Stock File/ Office Copy. *DIRECTOR ISM Thiruvananthapuram.*

Forwarded/ By order,

[Signature]
Section Officer.

Report of the Committee Constituted for Evaluating Indigenous Technologies and Selected Other Technologies for Waste Management in Households, Apartment Complexes, Residential Colonies, Schools, etc.

Members of the Committee constituted vide Letter No. SM/C2/2749/2011 dated 18.10.2011 for evaluating various indigenous technologies and other selected technologies for waste management in households, apartment complexes, residential colonies, schools, etc were:

1. Dr R V G Menon, Haritha, Poojappura, Thiruvananthapuram
2. Dr E V Ramaswamy, Director, Environment Sciences Division, Mahatma Gandhi University, Kottayam
3. Shri K Sundaran, Chief Engineer, Local Self Government Department
4. Shri K Sajeevan, Chairman, Kerala State Pollution Control Board
5. Shri N Jeevakumar, President, Vijayapuram Panchayat, Kottayam
6. Dr George Chackacherry, Executive Director, Suchitwa Mission
7. Shri M Dileepkumar, Director (SWM), Suchitwa Mission

The first meeting of the Committee was held during 29 – 30 November 2011 at Kanakakkunnu Palace, Thiruvananthapuram. Opportunity was given to all concerned to orally present their technology/method for waste management before the Committee during the period. The Committee physically evaluated various technologies/methods which were exhibited in the Exhibition organized by Suchitwa Mission at the Nishagandhi Grounds located in the premises of Kanakakkunnu Palace during the same period.

A total of 71 firms/agencies had submitted applications for approval of their technologies/products (List attached as Appendix 1). Most of the agencies displayed/demonstrated their technologies in the Exhibition. Majority of the agencies (numbering 40) had given their oral presentations in the workshop organized by Suchitwa Mission, as mentioned above, where the members along with the workshop participants clarified their doubts about the technology/ies. Many of the technologies offered are already approved by Suchitwa Mission and are in use. In addition to new methods/technologies, certain deviations/innovations have also been brought out in the existing technologies such as biogas plants, vermi compost units and other household systems.

The Committee later met on 02 February 2012 at the Office of Suchitwa Mission to finalise the findings and recommendations. Detailed deliberations and evaluations were carried out by the Committee on various aspects of waste treatment methods considered for households, apartment complexes, etc. as well as for institutions, hotels, hospitals (non-medical waste only), etc.

Findings/Recommendations of the Committee

Household Level

1. In addition to methods which were approved in the State for domestic solid waste treatment (such as compost pits, ring compost, pipe compost, vermi compost –different varieties of basins or vermi tanks like plastic/terracotta, potable biogas units of 0.5 and 1 m³ of all variations), all low cost waste treatment methods listed below may be allowed in household units and be eligible for grant of subsidy (Details are furnished in Appendix 2):
 - a. Pot composting
 - b. Bio-pedastal System
 - c. Mose pit
 - d. Bio-digester pot composting
 - e. Portable anaerobic bio-bins
 - f. Home compost polymer tumbler
 - g. Portable HDPE/plastic bin/bucket composting
 - h. Mini bio-pedastal
2. Preparation of project report is vested with the local bodies and subsidy shall be given to a beneficiary directly or through service providers.
3. Subsidy (presently @ 75%, with a maximum of Rs. 5,000 per household) may be given as one-time measure and shall be recorded in the Ration Card (The Committee feels that the rate fixed above for subsidy may be made applicable to biogas plants, whereas it may be limited to Rs. 500 per household in the case of composting units). Responsibility of giving subsidy shall be with the local bodies. It may be granted based on a certificate of completion from the Councillor/Panchayat Member of the Ward in which the house is located. Local bodies may form appropriate norms and select the list of beneficiaries.

Apartment/Organised Residential Colony Level

4. The apartments/residential colonies may install their waste treatment facilities through their associations with the consent of their dwelling units. In addition to the approved systems like biogas/vermi/windrow plants of suitable capacity, the Committee found that the following methods (Details are furnished in Appendix 3) are also suitable for approval:
 - a. Bio-bins/portable bio-bins
 - b. Centralised masonry bio-tanks
 - c. Aerobic ferro-cement bins
 - d. Organic waste converting machine (mechanical composting) method

The Committee felt that, though the agencies/firms claim complete success, the efficacy of these systems may be reviewed by an independent agency after a given period.

5. Subsidy (presently @ Rs. 500 per flat unit implemented at Thiruvananthapuram city only) may be given as one-time affair. Responsibility of giving subsidy shall be with the local bodies. It may be granted based on a certificate of completion from the Councillor of the Ward in which the apartment is located.

Institution Level (Schools, Hospitals, etc.)

6. In addition to the methods mentioned in section 4 above, bio-toilets with the technology approved by DRDO (Details furnished in Appendix 4) was found to be suitable for toilet waste treatment in schools, hospitals, etc.
7. The Committee felt that as the advanced biogas plants proposed by M/s Green Power Systems, Bangalore, and by M/s Renoris Greenery, Kozhikode, and the automatic plastic separation unit proposed by M/s STISCO, Kodungallur have been considered by another committee (Expert Committee for evaluating proposals for treating MSW on Pilot Scale) and their report has been released and therefore no further action is required. The Committee found that the comprehensive multiple system proposed by M/s ABG, Kochi, does not come under the scope of indigenous technology and the instant food waste disposar for commercial use proposed by M/s Spectrum Solutions is not appropriate to the present context, as it is not a waste treatment technique.

8. The Committee felt that the e-toilet presented by M/s Eram Scientific Ltd. is an innovation on toilets in public places and suitable for urban local bodies, urbanized panchayats, and tourist locations. However, as it is a high-tech Unit, its maintenance and service have to be assured, and availability of water and electricity are to be ensured for their satisfactory performance.
9. The Committee did not approve the incinerators and napkin destroyers proposed for consideration as they were of single chamber working in low temperature and not complying with CPCB norms.
10. Prasannan's solid waste treatment, liquid waste treatment and sewage treatment based Eco-bio-system has to be examined scientifically by an independent agency for its effectiveness and its effect on environment, as the technology behind the eco-bio-filters has not been revealed by proponent to the Committee. The proponent may get it analysed by a university/approved research institute and resubmit his application along with their report.

Other:

11. The Committee felt that though the agencies marketing inoculum claim their product eco-friendly, as there are competing agencies, impact of them on environment and effectiveness in composting may be studied. The agencies may get their inoculum analysed and efficacy evaluated by a university/approved research institute and resubmit their application along with their report.
12. Though there are several agencies/organizations dealing with the waste treatment technologies/methods mentioned above, many of the technologies/methods are exclusively proprietary in nature without any competition and their costs are decided by the respective agencies/organisations themselves. As the Committee cannot officially work out the cost, the beneficiaries/users may negotiate/bargain for a better pricing with the agencies/organizations concerned, or procure as per Government procedures

APPENDIX I: Demonstration cum Workshop on Indigenous Technologies in Waste Treatment held during 29 - 30 November 2011 at Thiruvananthapuram

Sl. No.	Agency/Individual	Technology	Contact No.	Email ID	Contact Person
1.	Social and Environmental Educational Society (SEMS), NH Road, Karamana Jn, Thiruvananthapuram	Biogas plants (Aerobic process)	9446614236	senskerala@yahoo.co.in	Shri. T M Saikishore (Director)
2.	Fibre Plast Industries Mundassery, Thrissur	Bio gas plant	9388453770	fibreplastindustries@yahoo.com	K L Anto
3.	ABS Fibre Products Palathara, Onakkunnu, Kannur	Portable Biogas Plant	9544778351		Biju T V
4.	Thanal, H3, Jawahar Nagar, Kowdiar PO Thiruvananthapuram-695 003	Pot Composting Zero waste Concept	9895182067 0471 2727150	zerowaste@thanal.co.in	Shri. Shibu K Nair
5.	Ram Biologicals 1/3442, Ayswarya Mansion, 1st Floor, West Hill PO Kozhikkode-673005	Biopedestal Column, Portable Biogas plant with spider and spring mechanism, package type waste water treatment plant, plastic reprocessing unit	0495 2380333, 3296858 9446042333	rambiol@rediffmail.com rambiological@gmail.com	Smt. Reena Anil Kumar
6.	Indian Centrifuge Engineering Solutions (ICF) Pvt. Ltd., C4 Industrial Estate, Ettumanoor	Bio toilet, Kitchen Waste Smasher	9745075180 0481 2532074	sambhusasikumar@gmail.com	Shri. Sambhu Sasikumar (Marketing Manager)
7.	Green Garison 50/628, LBS Cross Road, Edappally, Kochi-24	Aerobic Composting	9497025619	greengarisonkochi@gmail.com	Shri. E S Shajendran (Executive Director)
8.	Centre for Environment Education (CEE), No.404, Oam Nivas, Ambika Road, Pallikunnu, Kannur	Recycling and Reusable Tehnology	9847787311 09894860468 0497 2748600	ksdkannur@ceeindia.org	Shri. Prasannan (Project Assistant)
9.	Bio –Energy Tech, No.3, Valiyathura Building, Punthala, Purakkad PO,	Biogas Plant (Aerobic)	9995295012	vedipunthala@gmail.com	Shri.Thankachan

	Alappuzha				
10.	Kerala Agro Industries Cooperation, Kissan Jyothi Fort Thiruvananthapuram - 695 023	Bio gas plant	0471-2471343		
11.	Pioneer Paper Bag Unit, Vellar, Kovalam.P.O. Thiruvananthapuram- 695027	Paper Bag Unit	9633420766		Secretary
12.	Grow Green International (GGI), 36/2546, Asha Kiran, Azad Road, Kaloor Kochi-682017	Anaerobic Reactor FRP Portable	8943347204 0484 3935200	growgreen.international@gmail.com	Shri. Shaju J Nellisery (Chief Operation Officer)
13.	Energy Biolive, TC6/1775/4, Kizhakethayil, PTP Nagar, Thiruvananthapuram	Pleated Dome bio gas plant	9447903147	isaacsuresh@gmail.com	Shri. Suresh Isaac
14.	Navajyothi Social Welfare Society, MPM Building, Near KSRTC, Pathanamthitta	Most Pit- Low Cost Technology in Organic Waste Treatment	9400884158 0468 2244158	kcbmathew@yahoo.com	Shri. E V Thomaskutty (Director)
15.	Ideal Safety Systems Kannaneth Building, Pathanamthitta	Vermi Compost unit, Bio gas plant, Plastic Shredding Unit, Sanitary Napkin Wending	9495807480 0468 2325698	info@idealsafetysystems.com	Shri. O F Francis (Proprietor)
16.	Haritha Vermi Compost Industries Alakkode PO, Kannur	Vermi Compost	9447165135 9544996677		Shri. K A Sebastian
17.	Star Polymers UTC Compound, Muzhappilangad, Kannur	Plastic Recycling	9249723431 0497 6450536	ckbabu2010@gmail.com	Shri. C K Babu
18.	The Synod Bio Science Paradise Road, Vytilla, Kochi	Bio Gas Plant	9995994291 0484 4070404	zeesham@synod.in	Shri. Zeeshan
19.	Bharat Heritage Force, 44/378/A Manapattiparambu Behind RBI, Kaloor Cochin-17	Recycling Methods	9349830598 9539716351	bharatheritageforcebhf@yahoo.com	Shri. T M Venugopal

20.	Jyothi Bio gas & Rural Social Service Society Ottasekharamangalam PO Thiruvananthapuram- 695 023	Bio gas Plant	9895398585	jyothybiogas_chemboor@yahoo.com,	Shri. A Alfred
21.	Altima Technologies XVI, 373,374, Kanikkat Building, Elamana Jetty Road, Thripunithura, Kochi - 682301	Americal Technology formulated by Robic Laboratories Inc. USA (Biological Treatment Method)	0484-6538901/653805 4 9947225222	roebicaltima@yahoo.co.in	Shri. Baiju Ambatt (Manager Sales) , Shri. M.G.Sunil (Manager – Production)
22.	Nuro Systems Sales and Service Municipal Gandhi Bazar Shopping Complex, No. 7, Cherthala, Alappuzha-688524	Bio-gas plant	9846188088	nurowatersystems@gmail.com	Shri.Vinod D (Proprietor)
23.	Iringalakkuda Municipality		9142372143	secretaryijk@gmail.com	Shri. Seby
24.	Eram Scientific Janaki Bhavan, Sasthamangalam, TVM	e-Toilet	9447075025	kbn@eramscientific.net	Krishnan.B.Nair
25.	Evergreen Mission Community Development Services, Door No.XX/17, Thrikkakara PO Kochi-682 021	Eco friendly bio waste management system to decompose bio waste to organic manure	7736782290, 8089636101	info@evergreenmission.org	Shri. Varghese John
26.	The Andhyodaya MC Road, Angamaly-683 572	Mini Portable Biogas plant	9388607010 0484 2453548, 3254881	andhyodaya@gmail.com	Shri. Peter Thettayil
27.	Trichur Wholesale Cooperative Consumers Rice Bazar, Thrissur	Biogas plant	0487 2422690 9446621334	twccs239@yahoo.co.in	Shri. M N Nambisan
28.	Solar Tech, Malappuram	Solid Waste Treatment System	9447268435	newsolar@gmail.com	Shri. Anwar Sadath

29.	Renewable Energy Promotion Society, Sarada Fertilizers, Kanjany, Thrissur	Biogas Plants (Generators)	9447235305	phcarimbur@gmail.com	
30.	Unico India , Vazhuthacaud, VIP Road, Kaloor	Advanced Composting	8129099945	kavithagpillai@gmail.com	Smt. Kavitha G Pilla
31.	Integral Social Service Society TC 44/191, Thiruvananthapuram-695008	Kitchen Waste Management and Incineration	9349741032 9656178069	jobankisstvm@india.com	Shri. J Fraklin
32.	Thiruvananthapuram District Agricultural Science Graduates and Agricultural Technicians Cooperative Society Ltd., Azhikkal, Poovachal PO, Thiruvananthapuram-695575	Vermi Composting Bio Technology	0471 2290840	agri_co2004@yahoo.com	Shri. R C Sasidharan Nair
33.	Welfare Service Society Ponnuruni, Vytala Kochi-682019	Terra Cotta based vermin composting system and biogas plant	0484 2344243, 2347829	wseekm@gmail.com	Shri. Jeas P Paul
34.	Deepam Biogas agency, Neerillapuzha, Kadampuzha, Thiruvananthapuram	Bio gas plant	9847243763 0494 2618477	admin@deepambiogas.com	
35.	T M Cooperation VI/473A Crystal Garden, Kollam kodimugal Thrikkakara PO, Ernakulam-682021	Environmental Recycling System	9645529491	drphilipkunnath@gmail.com	Dr. Philip Kunnath
36.	Sree Tech, Avitom, By Pass Road, Manacuad PO, Thiruvananthapuram	Bio gas plant for portable model dome and fixed dome manner	0471 2507858 9496253913	sreetechtvm@gmail.com	Smt. Radhamani
37.	BIOES (Biogas Tech), First Floor, Room No.42, Revenue Tower, Adoor, Pathanamthitta	Dome Model Portable Biogas Plant, Modern Scum Barking Technology	9747457885 04734 226685	bioenviro01@gmail.com	Shri. K Jayakumar
38.	Jayan And Company Pattanakkad PO, Cherthala, Kerala- 688531	Portable Bio-Gas Plant		jayakumarrd303@hotmail.com	

39.	Zytech Systems Toms Park, Perumbavoor	Balloon Biogas Plant	9895715037	gishiprasad@gmail.com	Shri.Prasad
40.	Shri. Anandan D, Kailas, TC 5/2072, NRA C 17, Cheruvickal, Sreekariyam PO, Thiruvananthapuram	Green House Project	0471 2591276 9446331276	anandandivakaran@gm ail.com	
41.	Shri. Pradeesh R, B P Nivas, Moochikunnu, Thekkedesam, Nalleppilly	Infire Incinerator	9809799243	pradeeshram@yahoo.c om	
42.	SNEHA, Thuravur, Alappuzha	Vermi Composting	9847108780		Shri. Regunath Kartha
43.	Southern Engineering Works 5 TH Cross,V.K.Road Peelmedu. Coimbatore-04		09943952984	praji.southern.enggine ring@gmail.com	Shri. N. Prajithkumar
44.	V G Engineering Works, XXI/220, Industrial Development Plot , Poovanthuruthu PO, Kottayam-686012		9020596178		Shri. Appukkuttan
45.	Shri. S K Prasannakumar, Prasadam, Kulakkode Vellanad PO, Thiruvananthapuram-695543	Indigenous Sewage Treatment Plant	9446472524	skpkumarvellanad@gm ail.com	
46.	Jayasimha, Suryakanthi, TC.16/1460, JPN – 72, Jagathy, Thycaud, Trivandrum	Bucket Composting & kitchen Waste	0471 - 2325887 9633876542	jayasimhapk@gmail.co m	Jayasimha.P.K
47.	Impact Agencies, Door No.44/3158, Deshabhimani Road, Karukapilly, Cochin - 682017	Home compost tumbler	9846370804	paulimpactk57@gmail .com	Paul Francis
48.	Awera Eco Trust , 61 CH, Flyover Shopping Complex, Kannur Road, Calicut-673 005	Ecosan Biogas plants	04954099383 9388334485	info.awareecotrust@gm ail.com	
49.	Agro Machinery and Consultancy, Mini Industrial Estate, MC Road, Angamaly,	Biogas Plants			

	Kerala 683572				
50.	Shri. Balachandran, Thrissur	Biogas Plant (High Pressure)	9946164175	hitech37@ovi.com	
51.	Biogas Technical Kerala Development Society Pilathara, Kadambuzha PO, Malappuram	Portable Biogas plant 1 m ³ to 60 m ³	9744996600 0494 2615056	kmgc.in@gmail.com	Shri. K M Muhammad Rafi
52.	E M Technology, Cheriyam Ashram, Manarcad		9447367123 0481 2371964/1334	cheriland@rediffmail.com	Shri. John A J
53.	Bioflame, 2 nd Floor, Chity Chee Building, Bakery-Vashuthacaud Road, Bakery Jn., Thycaud PO Thiruvananthapuram	FRP Model & Bio waste Treatment Plant	9387774984 0471 2335344	bioflameindia@gmail.com	Shri. Alfred Bernad
54.	Shri .Rajan Manatil, Kozhikkode	Vermi compost, Domestic liquid waste management	9846027160		
55.	Sathya Biogas, Thaliparamba, Kannur		9400705266		
56.	Integrated Rural Technology Centre (IRTC) Mundur, Palakkad-678592	Solid Waste Management	0491 2832324 09447024920	irtcpalakkad@gmail.com pkrkssp@gmail.com	Prof. P K Raveendran
57.	Maple Orgtech India Ltd., Unit House, P-40, Block-B, New Alipore Kolkatta-700053, (Distributor-Eva Lifestyle, Thiruvananthapuram)	EM Technology	033-40608483 9674167121	surendran.rajana@mapleorgtech.com	Shri. Surendran M R
58.	Rajagiri outreach, Project Director, RAJAGIR outREACH, Kalamassery				Shri. M.P Antony
59.	Centre of Science And Technology For Rural Development, The Hamlet, Benedict Nagar, Nalanchira P O, Thiruvananthapuram-695 015	Deenabandhu Model	0471-2530031, 9446540220 0487-2365988	costfordtvm@gmail.com costford@sancharnet.in sajan_shailaja@yahoo.com	P B Sajan
60.	Grace Land Bio-Energy, Aryanad Junction, Aryanad P.O.,	Modern technology 1M3 Portable Model Biogas	9447861945	graceland.ard@gmail.com	

	Thiruvananthapuram	Plant			
61.	Reoris, Greenery, Kozhikkode	Biomethanation	9995411960	info@orisanter.com	
62.	Hi-tech Bio Fertilizers India and CREDAI Clean city, Kadavanthra	Aerobic Microbial Composting and Biogas	9447033360 9446523365	mail@cleancity.in	
63.	Bio Tech, PB No.520, MP Appan Road, Vazhuthacaud, Thycaud PO, Thiruvananthapuram-14	FRP Portable Model Biogas Plant	9446000963 0471 2321909	biotechindia@eth.net	Shri. P S Biju
64.	Asian Business Group, Universal Dwell Building, Cochin University PO, Kochi	Bio-Technology	9387118772	6533919@gmail.com	
65.	Nirmal Biogas Technology				
66.	Spectrum Solutions Branch of Prism Automations, Calicut . 24/459(3), Sugandh Building, Near Child Welfare Center, Thycaud, Trivandrum. 695014	Biological degradation of foodwaste cooked/uncooked by a motorized instant food waste pulverizing machine	9447127032	info@spectrumsolutionsindia.in prism.jk@gmail.com info@prismautomations.com	
67.	Sun Tech Industrial Steel Co.			mjoshy@gmail.com	Shri. Joshy mathew
68.	M Way Consultants and Developers Pvt. Ltd., Hiba Annex, Pada North, Karunagapally Post, Kollam-6950518	Composting Machine	9387733562 0476 2623188	aadinaseer.tcr@gmail.com doctorpvmajeed@yahoo.com	Shri. Mohammed Naseer
69.	National Energy and Waste Management				Shri. C L Anto
70.	Socio Economic Unit Foundation Vellayambalam, Thiruvananthapuram	Bio gas plant, Vermi Compost, Windrow Compost		seufhq@vsnl.net, seufthiruvananthapuram@gmail.com,	
71.	Green Power Systems Flat No.3Rindia Ventures,Oxford Towers No.139,Old Airport Road,Bangalore-560008	Compact Portable Bio-gas plant	080-42446600 09739050797	mainak@greenpowersystems.co.in manak.chakraborty@gmail.com	Sri.Mainak Chakraborty

APPENDIX –II: House-hold Packages

1. Pot Composting

Infrastructure and specifications

- (i) Mud pots about 50cm height and about 35 cm diameter at the centre , with lid covers -2 Nos
- (ii) Tripod stand 15cm high of appropriate design for keeping the pots made of wood /plastic/steel or brick pedestals - 2 Nos .
- (iii) Plastic vessel 10 cm high half litre capacity for collection of leachate coming out of the pots - 1 No.
- (iv) Trowel small size -1 No
- (v) Painting brush ½ “ size -1 No
- (vi) One brick cut into two pieces.
- (vii) Plastic covers -2 Nos

O&M Protocol

- (i) Make a small hole on the bottom of the pots carefully without breaking them
- (ii) Place the pots with lids on the tripods at a convenient place.
- (iii) Place the ½ litre capacity plastic vessel below one of the pots, selected for filling the waste initially.
- (iv) Start filling the segregated bio- waste(do not put slow degrading items and non-degradable items into the pots) daily into one pot and keep the pot closed. This type of waste treatment is capable of treating 1 to 2 kg of waste per day only.
- (v) Leachate coming out of the pot gets collected inside the plastic vessel placed below the pot. Put some salt powder into the plastic vessel to avoid entry of flies into this vessel. The leachate collected can be diluted with water and used as a manure in the garden
- (vi) Once the first pot is full, start using the second pot.
- (vii) Once the second pot become full, the waste in the first pot gets converted into compost.
- (viii) After first week of commencement lot of worms will be seen in the pot. Do not try to kill them, they activate the composting process and they die after 3 weeks.
- (ix) During rainy season open the plastic packets and spread the sheets obtained over the pots and place the brick pieces over the sheet to protect the pots from rains.
- (x) If the quantity of water inside the pot is more use some saw dust to absorb the water.
- (xi) If too much of flies seen around the pot, make a solution of 'camphor' in coconut oil (Dissolve two tablets in 25 ml of oil) and apply it on the bottom and top cover of the pot, by means of the brush.
- (xii) Sprinkling diluted rotten curd /cow-dung solution etc into the waste will speed up the composting process.

2. Bio-pedastal Composting

Infrastructure and specifications

- (i) Plastic bucket/vessel with open mouth around 25 litre capacity.- 2 Nos
- (ii) PVC pipe 200 mm diameter -1.0 m long.-2 Nos
- (iii) A plastic / ferrocement lid cover for closing the open end of the pipe -2 Nos.

O&M Protocol

- (i) Take a pit bigger than the size of the plastic bucket/vessel
- (ii) Keep the plastic bucket/vessel inside the pit
- (iii) Fill the plastic bucket /vessel with earth upto half the height.

- (iv) Place the pipe vertically into the vessel/bucket above the earth filling
- (v) Fill up the bucket/vessel and the pit with earth keeping the pipe portion inside.
- (vi) Keep the open end of the pipe seen above ground, closed with cover.
- (vii) Keep putting the bio- waste (easily digesting items only) into the pipe.
- (viii) Occasional pouring of cow-dung solution or warm rice water into the waste will be advantageous.
- (ix) The bio-waste get digested inside the vessel and get distributed evenly into the ground.
- (x) Plant a tree by the side of the pit which will absorb the manure.
- (xi) Shift the Bio-pedastal column to a different location after a year or so, if required.

3. Mose Pit

Infrastructure and specifications

- (i) Circular pits of required diameter and depth 1 metre in a convenient location - 2 Nos.
- (ii) Circular /rectangular slabs to fully cover the pit, with PVC pipe of required diameter, 50cm long, vertically placed centrally into the slab - 2 sets
- (iii) PVC caps to close opening of the pipe - 2 Nos
- (iv) Pit of size 60cm diameter and depth 1 m for a family of 5 members. Diameter of the pit may go upto 1.5 metre for institutions.
- (v) Restrict the depth to 1metre in all cases as methanogenic activities get reduced at lower depth.
- (vi) The bottom of the pit of oval shape.
- (vii) The cover slab of size 75cm diameter (for a pit of 60cm diameter) and thickness 7.5cm. PVC pipe of 100mm dia for domestic type and can be upto 200 mm diameters for bigger size pits.
- (viii) Cover the pit with the cover slab and spread earth over the slab .Only the pipe will be visible above the ground.

O&M Protocol

- (i) Ensure methanisation before putting the waste into the pit by sprinkling cow-dung / decomposed waste into the pit .
- (ii) Drop the shredded bio-waste into the pit through the pipe opening daily and keep the pipe end closed always.
- (iii) Pouring of warm water of 35 to 45 C temperature once a week will accelerate the decomposing.
- (iv) Occasionally pouring of cow-dung mixture or any methanogenic seed into the pit will also be helpful.
- (v) Keep using the pits alternately for six months each

4.Bio-Digester Pots

Infrastructure and specifications

- (i) Clay pots -3 Nos of approximate 30cm diameter and 30cm high each
- (ii) Earthen lid cover for pot -1No
- (iii) Old news paper
- (iv) Hand pump(sprayer)
- (v) Bio-compost or saw dust (Mavu,Rubber and Aryaveppu dust are not to be used)
- (vi) Specially prepared bio-culture.
- (vii) Steel fork

- (viii) The pots are locally moulded with clean clay /terracotta and oven dried, are to be kept vertically one above the other and the pot on the top is covered by a lid.
- (ix) The pot number 1 and 2 are kept at the top and middle position and are open on the top as well as bottom. The bottom open portion is weaved with plastic wires
- (x) Pot number 3 is kept at the bottom and is open at the top and closed at the bottom.

O&M Protocol

- (i) Sufficient to treat 2 kg of bio-waste per day.
- (ii) Place news paper sheets at the bottom of pot numbers 1 and 2 over the plastic thread to form a bio-platform.
- (iii) Spread starter material 1" thick over the bio-platform.
(Either prepared bio-compost or saw dust treated with bio-culture be used as starter material. Mix saw dust with diluted bio-culture (bio-culture: water ratio 1:50) like preparing rice powder for "Puttu " and keep it in a sack bag duly tied. After two days, saw dust mixture becomes hot inside by the activities of the bacteria. This hot mixture can be used as the starter.)
- (iv) Spread the shredded waste over the starter layer.
- (v) Spray diluted bio-culture mixture over the waste.
- (vi) Before closing the pot with the lid sprinkle starter mixture over the waste layer. Ensure water used for mixing the bio-culture does not contain chlorine. For that keeps the tap water in a open vessel for two days before use.
- (vii) Keep spreading the waste daily as above.
- (viii) Third day onwards stir/mix the old waste layer by using a fork without tearing the paper at the bottom, before placing the fresh waste on the top.
- (ix) Each time spray bio-culture mixture and then sprinkle starter over it before closing the lid.
- (x) Once the top pot is full ,shift the middle pot to the top and the top pot to the middle portion and repeat the process of spreading the waste into the new pot on the top in the same way as done earlier.
- (xi) Once the second pot also becomes full, tear the paper layer on the first pot (now in the middle position) and push the semi decomposed waste into the bottom pot.
- (xii) Shift this emptied pot to the top position and the top pot to the middle portion Continue filling the waste into the top pot as per the same procedure done earlier.
- (xiii) Now all the pots are full and the waste inside the bottom pot must have become compost and ready for use as manure in the garden. Empty it and continue the process as a routine.
- (xiv) Do not use excess water.
- (xv) This type of composting is suitable for a family of 4 to 5 members, generating 2 kg waste per day.

5. Portable Anaerobic Bio-bins

Infrastructure and specifications

- (i) Portable bio-bins - 3 Nos
- (ii) Cow-dung, black soil, jaggery, yeast, saw-dust or coconut husk
- (iii) Bio-bins are made of HDPE sheets each capable of composting 35 kg of bio-waste. Each bio-bin consists of three parts ,one bottom tray to collect the leachate ,the main bin compartment for depositing the waste and the top cover to close the bin.
- (iv) Plastic bins without the bottom tray also can also be used which may cost less. These are to be either buried underground or placed above ground within a brick chamber filled with earth to absorb the leachate.

O & M Protocol

- (i) Cut the segregated bio-degradable kitchen waste into pieces and deposit it in one of the bio-bins as a layer.
- (ii) Spray specially prepared bio-culture diluted with water in the ratio 1:100 into the waste layer.
- (iii) Sprinkle a mix of cow-dung, curd, black soil, jaggery, yeast, saw-dust or coconut husk (prepared mixture of these items is available at a cost of Rs 25/kg) over it .
- (iv) Next day deposit the waste of that day over the first layer of waste followed by bioculture mixture spray and sprinkling of the mix of cow-dung , jaggery etc
- (v) This bin gets filled up at the end of the month.
- (vi) Close the bin and keep it separately and start filling the second bin in the same way as done in the case of the first one ,till it gets filled up.
- (vii) On the third month, the same procedure is to be repeated again with the third bin.
- (viii) After completion of three months, the waste in the first bin gets converted into compost and is emptied for using it as a manure. The emptied bin is used to deposit the waste in the fourth month.

6. Home Compost Polymer - Tumbler

Infrastructure and specifications

- (i) Polymer Tumbler mounted on steel frame work -2 sets
- (ii) Microbe mixture

O&M Protocol

- (i) The waste is spread daily into one tumbler
- (ii). Microbe-mixture is sprayed into the waste layer daily.
- (iii) Rotate the tumbler one turn in a day by means of the frame work
- (iv). One tumbler for one month
- (v). Second tumbler for the second month.
- (vi). Empty the first tumbler at the end of the second month
- (vii). Use the first tumbler again in the third month.

7. Mini bio-pedestal

Infrastructure and specifications

- (i). Pit size sufficient to bury a domestic type waste basket -2 Nos
- (ii). House-hold waste basket with perforations -- 2 Nos
- (iii). PVC pipe 1.0 m long 20cm diameter. – 2 Nos
- (iv). PVC /ferrocement cap for 20 cm pipe -2 Nos
- (v). Broken stone 12/20 mm size

O&M Protocol

- (i) Cut a hole 20 cm diameter on the bottom of the waste basket
- (ii) Place the waste basket upside down into the pit
- (iii) Cut one end of the pipe angularly to chamber the edge.
- (iv) Insert the pipe into the basket with chambered edge inside the basket.
- (v) Fill up the gaps between the basket and the pit sides with broken metal
- (vi) Close the pit with earth and only the pipe will be seen outside.
- (vii) Two sets of such mini-pedestals for a house-hold.
- (viii) Keep dropping the waste into the pipe and keep the open end closed with the lid after dropping the waste.
- (ix) Use one pedestal for one week and second pedestal for next week.

- (x) Keep using the pedestals alternately.
- (xi) Taking out the waste may be done only if required.
- (xii) Grow a plant near to the pit.

8. Portable HDPE /plastic bin/ bucket composting

Infrastructure and specifications

- (i) Plastic or HDPE buckets/pots 50 litre capacity with lid cover duly fitted with a tap outlet on the side at the bottom most point - 2 Nos
- (ii) Coconut shells - sufficient numbers
- (iii) Bricks 4 Nos for placing the bucket/pot inside the tray.
- (iv) Small plastic vessel /mug 15 to 20 cm high for collection of leachate
- (v) Plastic net 0.5m x 0.5m size
- (vi) Plastic tray approximately 0.5m diameter to keep the bucket inside
- (vii) Wooden spoon (Thavi)

O&M Protocol

- (i) Stack a layer of coconut shells in inverted position at the bottom of the bucket/pot. Place the plastic net cut to the shape over the layer of coconut shell.
- (ii) Place two sets of bricks inside plastic tray and keep the prepared bucket /pot as (i) above over the bricks for convenience of draining the leachate into a plastic vessel to be placed inside the plastic tray just below the tap outlet.
- (iii) Start loading the bio -waste into the bucket/pot on the layer of coconut shells daily . Occasionally mix the fresh waste with the old waste by using the wooden spoon.Keep the bucket /pot closed with the lid cover.
- (iv) One bucket/pot will become full in 25 to 30 days time in a family of 5 members.
- (v) Close the bucket/pot with lid cover and start using the second set.
- (vi) Keep draining the leachate as it comes out.
- (vii) After two weeks pour one mug of water into the closed filled up bucket after opening the lid and collect the leachate which comes out of the bucket from the tap which can be used as a manure or dispose it off.(Optional)
- (viii) Once the second bucket gets filled , the waste in the first one will be ready as compost. Empty it and reuse the bucket/pot for further storing the waste.

9. Pit Composting units

This is the most conventional type of composting prevalent and can be adapted where there is adequate space available in the backyard.

Infrastructure and Specifications

- (i) Two pit of adequate size be dug
- (ii) Tarpaulin or PVC roofing sheets to cover the pits
- (iii) Cow-dung , loose earth
- (iv) Tools like shovel, mumty etc
- (v) Pits of adequate size to bury the bio-degradable waste of 6 months in each pit
- (vi) Pits of length 1m and width 60 cm and depth 1m for a family 5 or 6 members .
- (vii) Bigger size pits for bigger families according to the requirements.
- (viii) Dig the pits in an elevated place where there is no chance of water getting collected. If not take adequate pre-caution to avoid ingress of rain water into the pits like raising a small bund around the pits etc.

- (ix) Honey comb brick lining may be provided inside the pit on all the four sides if the strata is loose and there is chance of collapse of sides.

O&M Protocol

- (i) Spread a layer of cow-dung slurry or decomposed waste on the bottom of the pit before start dumping the waste.
- (ii) Start spreading the waste (only bio-degradables) over the cow-dung or decomposed waste layer .
- (iii) Bigger sizes of the waste is to be cut into small pieces for easy de-composing.
- (iv) Sprinkle a small earth layer over it daily to avoid bad smell from the pit.
- (v) Repeat the procedure daily -spread the waste first, and then the earth layer.
- (vi) Once the pit is filled up fully , close the pit by spreading a layer of 15 cm of earth .
- (vii) Once the first pit is closed keep dumping the waste in the other pit on the same way.
- (vii) Once the waste in the first pit becomes compost after a period of 4 to 6 months, clear the pit and make it ready for further use. The compost can be disposed off or used as a manure.
- (viii) Protect the pit from rainwater ,keep it covered by means of tarpaulin or PVC roofing sheet.

10. Pipe Compost

Infrastructure and specifications

- (i) Pipe pieces of 200 mm diameter , 1.0 metre long each.- 2 Nos
- (ii) Top lid cover made out of ferrocement for 200mm pipes.- 2 Nos
- (iii) Pit of 200mm diameter and depth 30cm.
- (iv) The PVC pipe of 2.5kgf /cm² pressure rating
- (v) The caps can be of PVC or ferro-cement specially manufactured.

O &M Protocol

- (i) Erect /fix the pipe vertically inside the pit.
- (ii) Activate the methanisation process by pouring small quantity of cow-dung mix into the pipe
- (iii) Cut the segregated bio-waste into small pieces and drop it into the pipe
- (vi) Keep the pipe closed with the lid cover
- (vii) Occasionally sprinkle cow- dung mixture or warm rice water(Kanji) into the waste layer to activate the decomposing process.
- (viii) Keep the lid always closed.
- (ix) Once the pipe is filled up to the top close it and start using the second pipe.
- (x) When the second pipe is filled the first be removed from the pit and push the decomposed waste out by inserting a steel /bamboo rod from the other end.
- (xi) Decomposed waste can be used as compost.
- (xii) This arrangements for a small family of 4 or 5 members.
- (xiii) More number of pipes for bigger families.

Other:

Vermi tanks made of plastic, terracotta, fibre, etc. for vermi composting and variations available in the market in the case of portable biogas units of 0.5m³ and 1m³ capacities could also be encouraged depending on the convenience of users.

APPENDIX- III: Flats/Colony /Institution Packages

1. Portable Bio-Bins for flat complexes/residential colonies

This method of solid waste treatment is most ideal for treating domestic bio-degradable solid waste generated (kitchen waste) in a Flat Complex. The waste is treated in portable 'Bio-bins' centrally; the terrace space can be utilised for the treatment.

Infrastructure and specifications:

- (i) 'Bio-bins' each of size 180cm x 90cm and height 75cms and sufficient to treat 40 to 45 kg of kitchen waste per day – 2 Nos
- (ii) Sprayer 1 litre capacity for spraying the bio-culture mixture
- (iii) Steel fork –big.
- (iv) Steel fork small
- (v) Steel chatti 40cm dia for emptying the compost
- (vi) Flux drying sheet 2 metre for drying of compost
- (vii) Steel cutting knife with handle
- (viii) Bio-culture
- (ix) One set of two bio-bins of size given above are sufficient to treat waste generated from 40 families with 4 members producing 1 kg of waste per day.
- (x) In case, number of families are more, either additional set of Bio-bins or higher size bins are to be provisioned. Size and number of Bio-bins depend upon the number of families residing in the building /group of buildings.
- (xi) These bins are rectangular box shaped containers with openable lid cover, made of fibre reinforced plastic panels which can be easily assembled at site and kept in the terrace, ideally suited for flats.
- (xii) The sides of the bins are properly ventilated to suit for aerobic microbial composting.
- (xiii) Open space available in the terrace can be used for keeping these bins and there is no requirement of any additional built up area for this purpose.

O&M Protocol

- (i) Segregate the waste at the source and only the bio-degradable waste is collected for treating in the bins.
- (ii) Cut the segregated bio-degradable domestic (kitchen waste) into small pieces using the steel knife and deposit inside these bins. (No plastic or any other non-biodegradable waste to be put into the bin).
- (iii) Spray the specially prepared bio-culture solution simultaneously into the layer of waste.
- (iv) Continue the process daily like, depositing the waste and the spraying the specifically prepared bio-culture etc.
- (v) One bin is sufficient to contain the waste of first 15 days and after 15 days close the bin by means of the lid cover.
- (vi) Turn the waste and mix it occasionally may be once in two days by means of the steel fork till it is converted into compost.
- (vii) After the first bin is closed use the second bin for depositing the waste for next 15 days. Follow the same procedure.
- (viii) By the time the second bin is full, the waste in the first bin get converted into compost, empty it and dry it in the terrace for a day to remove

the water contents ,if any .Then the compost is ready to be utilised in the garden as manure.

- (vii) Use the emptied bin for further use.

2. Centralised masonry bio-tanks

Infrastructure and Specifications

- (i) Centralised bio-bin tanks of size required for storing one months' waste, constructed in a central place, using R/R masonry plinth and brickwork walls. Tank size of 2m x 1.2m x 1 m depth for a flat complex of 40 units - 3 Nos
- (ii) Temporary roof to protect the tanks from rains
- (iii) PVC net cover in a frame work to protect the tanks from birds etc – 3 Nos
- (iv) Bio-culture
- (v) Mixture of cowdung, jaggiry, saw dust, yeast, coconut husk etc

O&M Protocol

- (i) Spread the collected bio-degradable waste from the flat units inside one of the bio- tanks
- (ii) Spray diluted bio-culture into the waste layer.
- (iii) Sprinkle the mixture of cow dung, jaggiry, yeast, coconut husk etc over the waste.
- (iv) One tank for one month's waste.
- (v) Use the second tank for the second month.
- (vi) Use the third tank for the third month.
- (vii) Drain the leachate generated through a tap provided at the bottom of the tank. and use it as manure in the garden or dispose off through a septic tank /soak pit.
- (viii) Empty the waste in the first tank (which must have become compost) at the end of the third month.
- (ix) Repeat the process.

3. Organic Waste Converting Machine (mechanical composting) method

Infrastructure and Specifications

- (i) Bio-waste converting machine of appropriate capacities-available sizes are 10 kg /25kg/50kg/125 kg/250 per batch. 3 batches per hour and 7 to 8 hrs of operation is suggested per machine.
- (ii) Plastic baskets 20 kg capacity .Number as required for curing of 10 days waste basis.
- (iii) Rack for stacking plastic baskets filled with semi-treated waste with humidity control arrangements.
- (iv) A room of size 3mx4m for (base model machine) installing the machine.
- (v) A well ventilated space for keeping the rack with baskets.
- (vi) Power connection for bio- waste converting machine 4KW to 10 KW 3 phase
- (vii) Bioculam, saw dust, water connection etc.
- (viii) The higher size plants will have extra double shredder (25 kg batch and above) and conveyor belt for unloading the waste from the machine to the basket for capacities of 125 and 250 kg batch as part of the package.

O&M Protocol

- (i) The segregated bio-waste mixed with bio-culam powder at the rate of 1 gram per kg of waste is loaded into the Bio-waste converting machine.
- (ii) If the waste is dry mix the bioculam in water at the rate 1 kg in 30 litre of water and then add to the waste in liquid form. If the waste is soggy, add a small quantity of saw dust to reduce the water content.
- (iii) Run the machine for 15 minutes.
- (iv) Unload the semi-treated waste into the basket kept under the machine .
- (v) Shift the basket with the waste to the cooling rack.
- (vi) The cooling rack is to be located in a covered space with adequate ventilation arrangements.
- (vii) Keep watching the moisture content of the waste to remain 40%.
- (viii) Excess water is drained out and water sprayed in the mist form to the waste kept in the cooling rack to adjust its moisture content .
- (ix) Waste is converted into compost in a period of 10 to 15 days.

5. Aerobic ferrocement tanks

Infrastructure and specifications

- (i) Ferro-cement tanks size 4'x4' x4' -4 Nos for 40 families
- (ii) Cow-dung mixture
- (iii) Bio-culture
- (iv) Tanks constructed by assembling ferro-cement slabs width 4cm thickness 2cm on four ferro-cement legs to form a box with four sides. It is placed on a level ground under a roof. Both the bottom and top sides are open. There is a gap of 2 to 3 cm between the slabs for aeration.

O&M Protocol

- (i) Spread daily waste in layers
- (ii) Sprinkle cow-dung mixture /bio-culture over the waste layer
- (iii) Use two tanks at a time in complexes with 40 families of 4 /5 members each .
- (iv) The tanks will get filled up in 45 days' time.
- (v) After first set of tanks are filled up the second sets are to be used.
- (vi) Once the second sets are filled up, the first sets are to be emptied as the waste in the first set must have become compost