CAMUS-SBT

OVERVIEW


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1. Introduction

Soil Biotechnology (SBT) is covered by two US patents (Patent no 6890438B2 and 7604742B2) and 2 Indian patents (Patent no 203744 & 203425) all assigned to IIT Bombay. CAMUS-SBT is advanced version of the basic SBT technology which uses less space, is easier to operate and offers superior water quality.

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2. The CAMUS-SBT Technology

2.1. Introduction

Water is a scarce resource. Water treatment provides usable water for domestic agricultural & industrial purposes; helps to conserve & enhance water in quality & quantity; in addition prevents degeneration of our water sources of surface & ground. Green technologies today provide impressive water quality at competitive costs without contributing to global warming. This technical specification presents a green biological purification engine using a natural novel high efficiency oxidation process variably known as CSF (constructed Soil Filter) or SBT (Soil Biotechnology) developed at IIT Bombay by Prof H.S.Shankar & his students.

Soil Biotechnology (SBT) is covered by two US patents (Patent no 6890438B2 and 7604742B2) and 2 Indian patents (Patent no 203744 & 203425) all assigned to IIT Bombay. CAMUS-SBT is advanced version of the basic SBT technology which uses less space, is easier to operate and offers superior water quality.

2.2. Process

The technology is based on a bio-conversion process where fundamental reactions of nature, namely respiration, photosynthesis & mineral weathering take place in a media housing micro & macro organisms which bring about the desired purification. CAMUS-SBT is an oxygen supplying biological engine and so the process can treat all types of water – domestic municipal & industrial. CAMUS-SBT is suitable for treating water with salinity <2500 mg/L. For higher salinity special designs are available.

The process requires mesophyllic temperatures; so where the ambient temperatures are very low a greenhouse infrastructure appropriate for the local conditions houses the CAMUS-SBT plant. However the process can work at high ambient temperatures.

The facilities of a treatment process for water & waste water consists of a raw water tank, bioreactor containment , treated water tank and where appropriate a greenhouse and associated piping ,pumps & electrical. Schematic of the process is shown in Fig 2.1.

Bioreactor containment houses i) the media , ii) the culture, III) the additives and iv) the plantation required for the bioconversion; Fig 2.2 shows the four pillars of the process.

Water or waste water is pumped over the bioreactor; the suspended solids are removed by the top media which is scrapped and discarded into municipal solid waste. The water trickles into the bed and treated water collects in the filtrate tank. Recirculation pumps are provided to obtain desired hydraulic retention times; in general purification to desired quality is achieved in one pass and so these recirculation pumps are not used.

The scheme for drinking quality raw water, swimming pool water, rain water & storm water & waste water treatment are identical to description above. Fig 2.3 shows schematic of multi-level designs; here CAMUS-SBT bioreactor is developed at each level and arrangements for pumping & piping to the different levels are provided.

The layout of media on the bioreactor is shown in Fig 2.4.The specific layout engaged depends on site conditions.

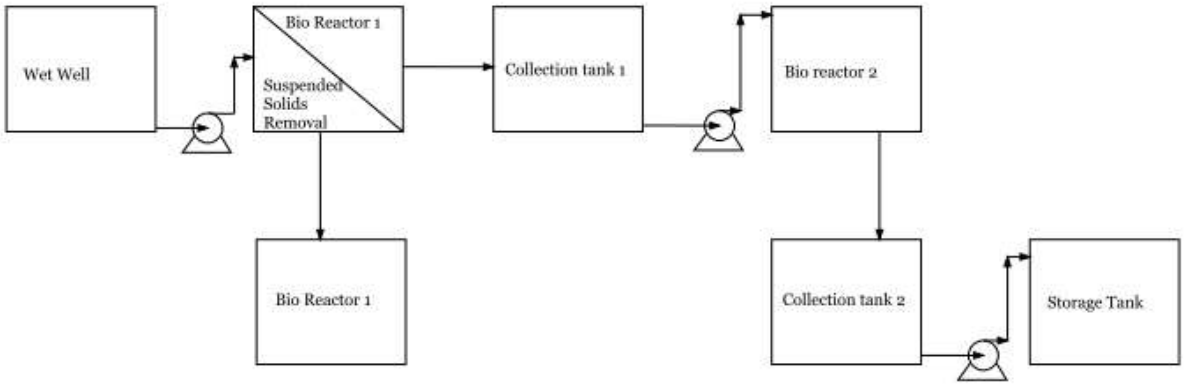


Figure 2.1: CAMUS-SBT/SBT Process Flow: Raw water is screened and collected in raw water tank or wet well (RWT/WW). A lift pump P1 lifts water from RWT/WW and distributes it over Bio reactor (BR). Optionally the water can be routed through a Flocculation system and Settler (TS) to remove suspended solids and clear water from top is then distributed over BR via optional pump P2 or via gravity head if feasible. Treated water from BR is collected in treated water tank or collection tank (TWT/CW). Treated water can be reused or discharged as desired using recycle pump P3.Suspended solids from TS bottom are spread over a section of BR if it is nearby or in an optional drying bed.

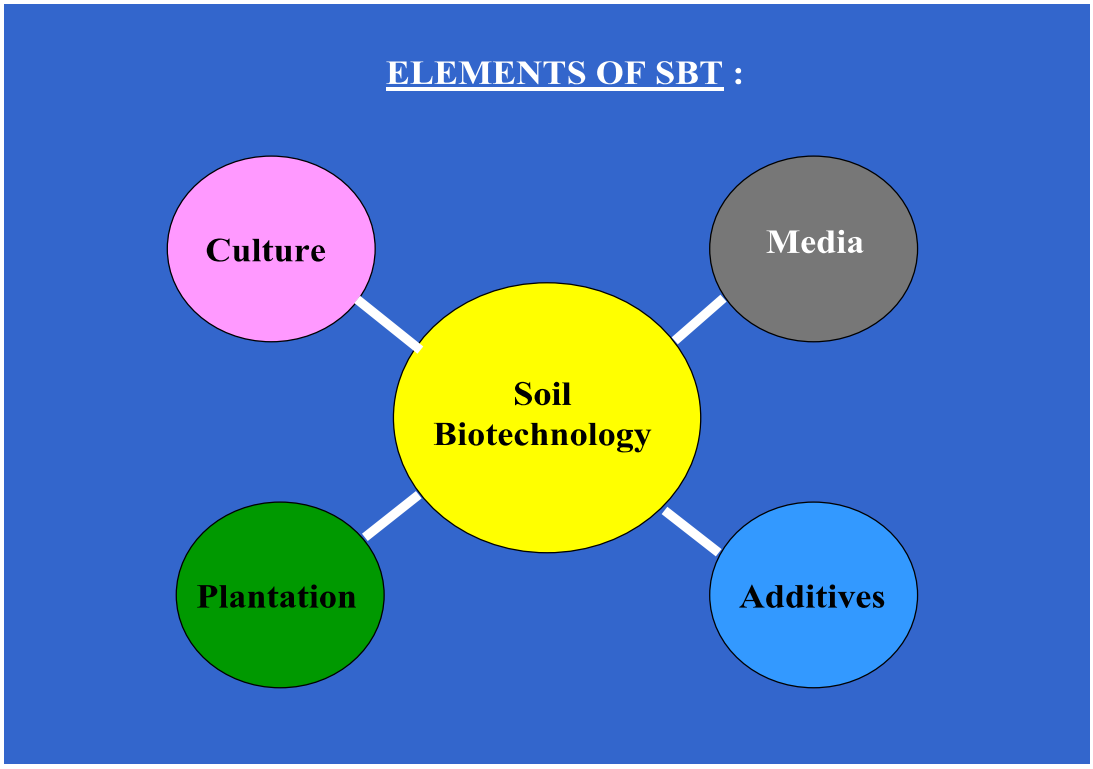


Fig 2.2: Elements of CAMUS-SBT

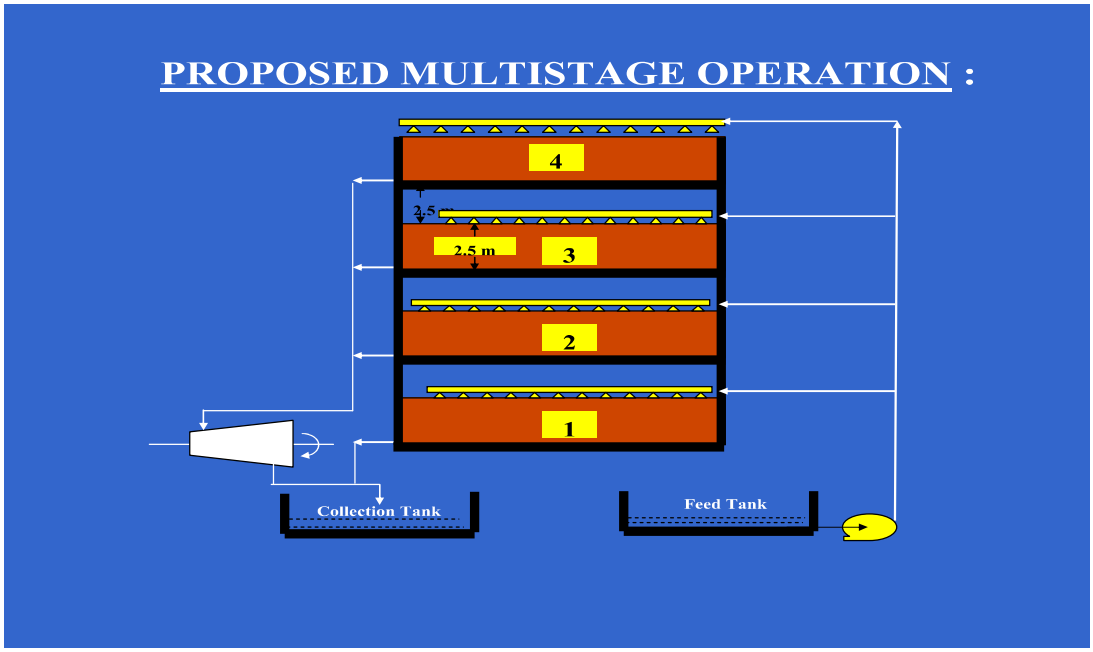


Fig 2.3: Proposed Multistage Operation

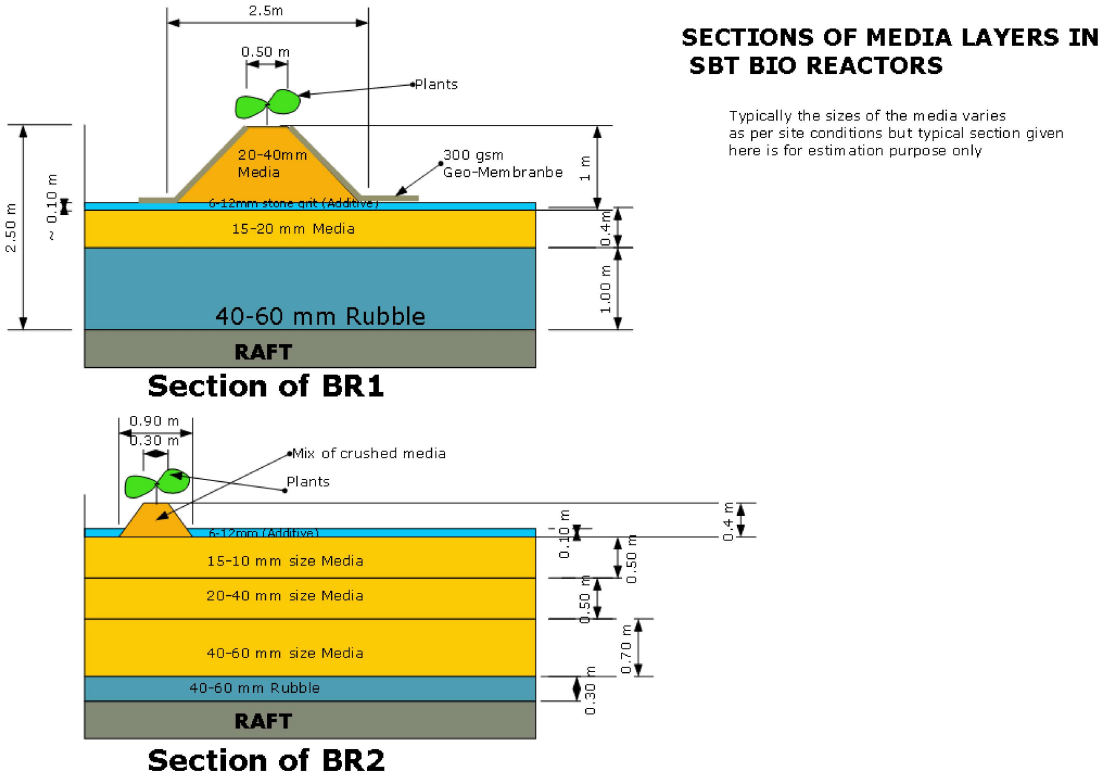


Fig 2.4-a: Layout of CAMUS-SBT Media in civil containment

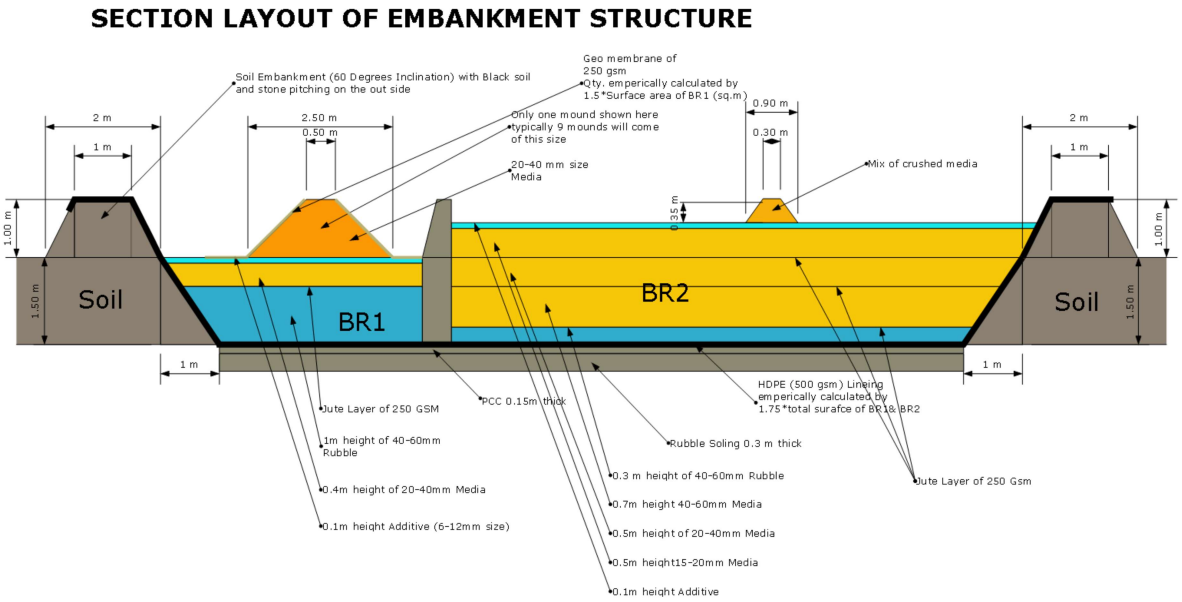


Fig 2.4-b: Layout of CAMUS-SBT Media in Soil embankment containment

2.3. Building & equipment components for construction of CAMUS-SBT plant

CAMUS-SBT plant is essentially a civil structure. However the civil structure can be also being all steel, if required; for small capacities this may be ideal. It comprises of screen chambers, tube settler (optional), tankages, bioreactor containment & a pump room and piping & pumping arrangements.

2.3.1 Waste Water treatment:

- Coarse and Fine screen chambers: Raw water consists of coarse and fine solid particles, to remove that by using bar screens of 5 mm and 3 mm aperture size for coarse and fine particles respectively.
- Tube settler: Removing suspended solids by tube settler and it designed based on quantity of suspended solids. It is optional because the CAMUS-SBT system is itself able to remove the suspended solids by top layer of reactor, but it needs regular maintenance to rake out top layer of bio-reactor.
- Raw water and Treated water tankages: The raw water collection or equalization tank which is designed based on one day hold up. The treated water tank design based on needs of discharge.
- Bio-reactor containment: The civil structure of the CAMUS-SBT plant is typically of stone rubble or RCC, steel and sometimes soil embankment. Bio-reactor media is patented material as per ***US Patent no- 6890438B2 / 7604742B2***.
- Mechanical and Piping elements: The whole process is operated by two pumps only. Pumps are typically self priming& submersible type as per site conditions. The piping system for the CAMUS-SBT plant is typically of 8 kg/sq.cm HDPE pipes; but PVC & GI or other materials as per site conditions. All valves compatible with high pressure corrosion free service is fine for CAMUS-SBT plant.

- Electrical elements:The control panel will have the provision for two raw water pumps, 1 recycling pump, 2 discharge pumps and 1 small dosing pump for disinfection. All electrical cables switches alarms monitors & displays are as per design & safety requirements of the process on hand.

In some cases particularly near airports, if birds are to be kept away; the plant environment is covered by wirenet and where required creepers are grown over it.

2.3. Technical specifications of output water for CAMUS-SBT

Water purification Process Specification: The specifications for tankages & bioreactor required to treat water & waste water, solid & hospital waste are obtained from process models & laboratory investigations. Table 2.4.1 summarizes the data required for design. CAMUS-SBT can designed any type of waste water provide the waste water is not saline (typically TDS< 2500 mg/L). In all other cases CAMUS-SBT can be designed to handle waste water loads to standards required.

Table 2.4.1 Data required for design

S No	Item	Values
1.	pH	
2.	DO	
3.	BOD (mg/L)	
4.	COD (mg/L)	
5.	Suspended solids (mg/L)	
6.	Ammonia –N (mg/L)	
7.	Fecal coli forms (CFU/100 mL)	
8.	Flow average kLD	
9	Peak flow kLD	

2.4. Safety

The CAMUS-SBT process involves no moving parts excepting feed & discharge pumps. So safety needs are minimal. However gloves & gum boots are required while handling solids and during movements in the plant area so that accidental fall into tanks are avoided. Accordingly all tanks are provided closures and ladders.

2.5. Personnel Training

Personnel training required are i) routine pump operation & maintenance ii) routine O&M of plantations. These instructions are imparted during commissioning and trial run period by manufacturers and their associates.

2.6. O&M of CAMUS-SBT plant

The water purification plant works on the principle of Soil Biotechnology which applies the biochemistry of nature in a concentrated manner. It aims at enriching soil & extracting excellent water for use in drinking, irrigation, fisheries, industries & construction & fire-fighting. The solid waste facility also uses the same principle to process waste for disposal or for conversion to fertilizer.

- O&M of pumps & pipes: All pumps should be run daily to ascertain maintenance requirements. All monitors & alarms should be checked daily. All pipe ports should be maintained daily to ensure that water flows out of all the ports. All valves & fittings should be checked and where faulty should be restored.
- Bioreactor: The top surface should be scrapped daily/weekly as necessary and the solids should be disposed. The top surface additives should be replenished periodically once says every 8 weeks.
- Plantation: The plantation on the bioreactor and surroundings should be regularly watered pruned, replaced and provided with manure as required.
- Tanks: All tanks should be thoroughly scrapped to remove adhering dirt and washed.

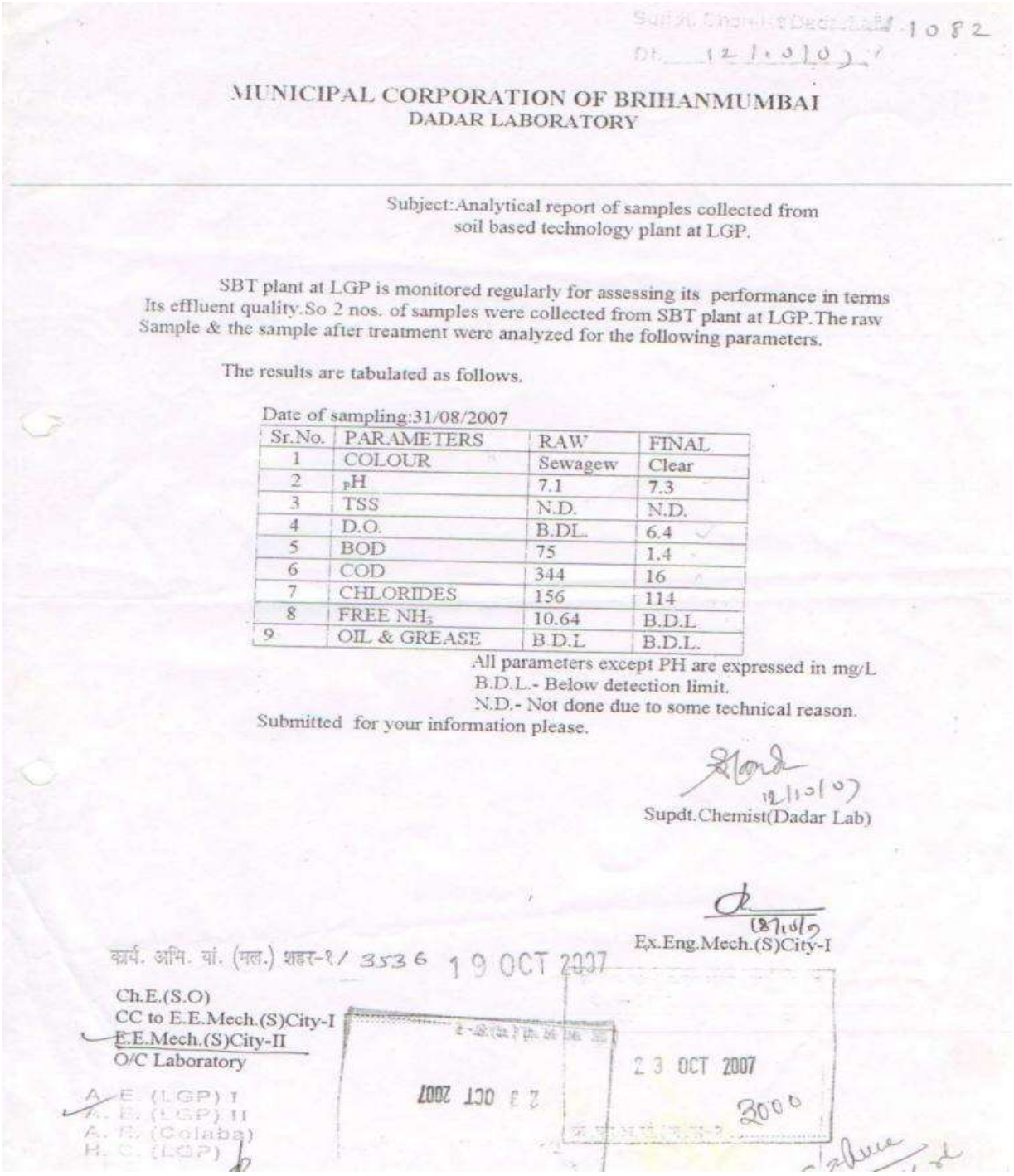
3. Detailed Specifications

Table 3.1: Material specifications of 1000 KLD CAMUS-SBT plant

Size(KLD)	**1000**	
Peak Flow Factor	**2.2**	
Average Flow (cu.m/hr)	**41.7**	
Peak Flow (cu.m/hr)	**91.74**	
Design Flow (cu.m/hr)	**62.5**	
Item	**Qty**	**Unit**
ITEM 1: Auxiliary Facilities (not part of CAMUS-SBT system)		
Screen SS (perforated mesh)	16	Kg
Screen Chamber	1	Nos
Raw Water Sump (@2hr retention@peakflow)	180	cu.m
ITEM 2:SBT/ CAMUS-SBT Bio Reactor Facility	**Area**	**1500-2000sq.m**
Civil (Stone Masonry Wall, Earthen Waterproof Floor)		
Excavation	1650	cu.m
Water Proofing (Floor only)	2650	sq.m
Stone Masonry Wall	360	cu.m
Pump House	40	sq.m
Collection Well	41.7	cu.m
Media	**Volume**	
Media Procurement (as per CAMUS-SBT copyright)	2500	cu.m
Transport	3750	Ton
Sizing and Laying	2500	cu.m
ITEM 3: Mechanical		
SS Removal Facility	Lumpsum	
Wet Well Pump working (10m head @ design flow)	1.4	KW
Collection Pump working (10m head @ design flow)	1.4	KW
Piping (distributor = 1.5” UPVC SCH 40 ASTM)	730	M
ITEM 4: Electrical		
Panel and Cabling (pumps, Lighting, pump house)	3	KW
ITEM 5: Technology		
Technological Consultancy	1	Nos
Supervision & Commissioning	80	Man days
Culture and Catalyst	7	Ton
ITEM 6: Annual O&M		
Operators/Gardeners	4	Nos
Power	26500	KWHr
Consumables	2	Ton
Technical Support	1	Nos

4. Test certificate for CAMUS-SBT technology

CAMUS-SBT technology is installed by the following agencies



MUNICIPAL CORPORATION OF BRIHANMUMBAI
DADAR LABORATORY

Subject: Analytical report of samples collected from soil based technology plant at LGP.

SBT plant at LGP is monitored regularly for assessing its performance in terms Its effluent quality. So 2 nos. of samples were collected from SBT plant at LGP. The raw Sample & the sample after treatment were analyzed for the following parameters.

The results are tabulated as follows.

Date of sampling: 31/08/2007

Sr.No.	PARAMETERS	RAW	FINAL
1	COLOUR	Sewagew	Clear
2	pH	7.1	7.3
3	TSS	N.D.	N.D.
4	D.O.	B.DL.	6.4
5	BOD	75	1.4
6	COD	344	16
7	CHLORIDES	156	114
8	FREE NH_3	10.64	B.D.L
9	OIL & GREASE	B.D.L	B.D.L.

All parameters except PH are expressed in mg/L
B.D.L.- Below detection limit.
N.D.- Not done due to some technical reason.

Submitted for your information please.

Supdt.Chemist(Dadar Lab)

Ex.Eng.Mech.(S)City-I

कार्य. अभि. यां. (मल.) शहर-१/ 3536 19 OCT 2007

Ch.E.(S.O)
CC to E.E.Mech.(S)City-I
E.E.Mech.(S)City-II
O/C Laboratory

23 OCT 2007

Fig 4.1: Scan of test certificate of treated water from BMC Bombay

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Issued to:
M/s. Godrej Household Products Ltd
Coil -9 Factory
RS No:74/4,74/5,74/6 Nallur Village,
Mannadipet Commune,
Puducherry -605111

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E-mail : enquiry@sargamlabs.com
accounts@sargamlabs.com
Website : www.sargamlabs.com
Recognised by MoEF, Ayush
Approved by Drug Controller of India, EIC & APEDA

TEST REPORT

Report Number: 953924

Report date : 20.11.2010
Page : 1 of 1

Sample Description : SBT Inlet Water
Received on : 12.11.2010

Sample drawn by / Date : Laboratory Representative / 11.11.2010
Customer's reference : PO NO.: 1500005971 dated 30.10.2010
Commenced on : 12.11.2010
Completed on : 19.11.2010

PARAMETERS	RESULTS	PROCEDURE :APHA 21st Edition 2005
pH at 25°C	7.49	4500 H^+ A, B
Total Dissolved Solids	844	2540 C
Total Suspended Solids	48	2540 D
Chlorides as Cl-	105	4500 Cl- B
Sulphates as SO4—	36	4500 SO_4^{2-} E
Oil & Grease	19	5520 O&G B
BOD (3 days /27°C)	57	IS 3025 1993 R.2003 P. 44
COD	198	5220 C

Results expressed in mg/l. except pH

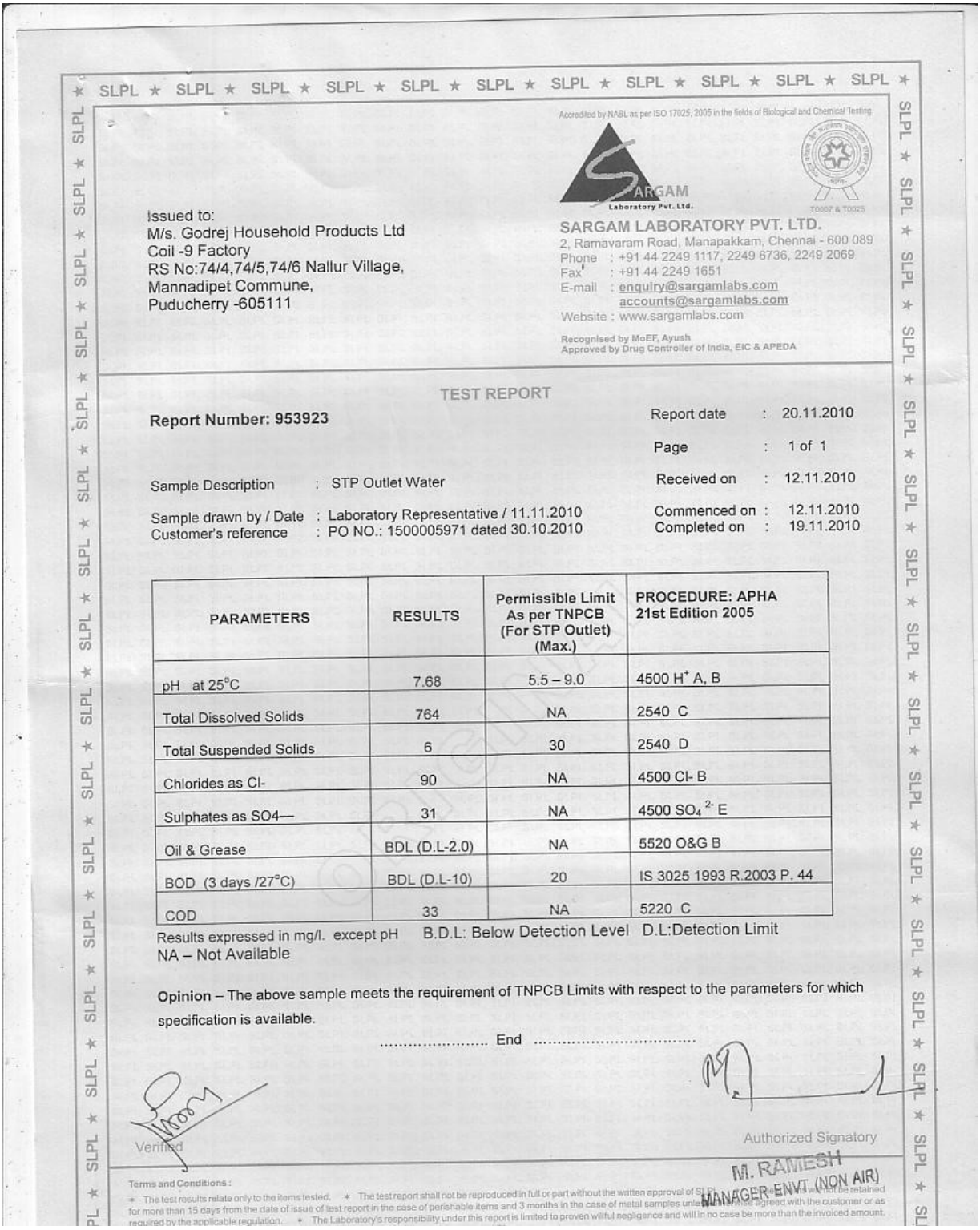
..... End .....

Verified

Authorized Signatory

M. RAMESH
MANAGER ENVT (NON AIR)

Terms and Conditions :
* The test results relate only to the items tested. * The test report shall not be reproduced in full or part without the written approval of SLPL. * Perishable items will be retained for more than 15 days from the date of issue of test report in the case of perishable items and 3 months in the case of metal samples unless otherwise agreed with the customer or as



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Website : www.sargamlabs.com

Recognised by MoEF, Ayush
Approved by Drug Controller of India, EIC & APEDA

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Coil -9 Factory
RS No:74/4,74/5,74/6 Nallur Village,
Mannadipet Commune,
Puducherry -605111

TEST REPORT

Report Number: 953923

Report date : 20.11.2010
Page : 1 of 1

Sample Description : STP Outlet Water
Received on : 12.11.2010

Sample drawn by / Date : Laboratory Representative / 11.11.2010
Customer's reference : PO NO.: 1500005971 dated 30.10.2010
Commenced on : 12.11.2010
Completed on : 19.11.2010

PARAMETERS	RESULTS	Permissible Limit As per TNPCB (For STP Outlet) (Max.)	PROCEDURE: APHA 21st Edition 2005
pH at 25°C	7.68	5.5 – 9.0	4500 H^+ A, B
Total Dissolved Solids	764	NA	2540 C
Total Suspended Solids	6	30	2540 D
Chlorides as Cl-	90	NA	4500 Cl- B
Sulphates as SO4—	31	NA	4500 SO_4^{2-} E
Oil & Grease	BDL (D.L-2.0)	NA	5520 O&G B
BOD (3 days /27°C)	BDL (D.L-10)	20	IS 3025 1993 R.2003 P. 44
COD	33	NA	5220 C

Results expressed in mg/l. except pH B.D.L: Below Detection Level D.L:Detection Limit
NA – Not Available

Opinion – The above sample meets the requirement of TNPCB Limits with respect to the parameters for which specification is available.

..... End .....

Verified

Authorized Signatory

M. RAMESH
MANAGER-ENVT. (NON AIR)

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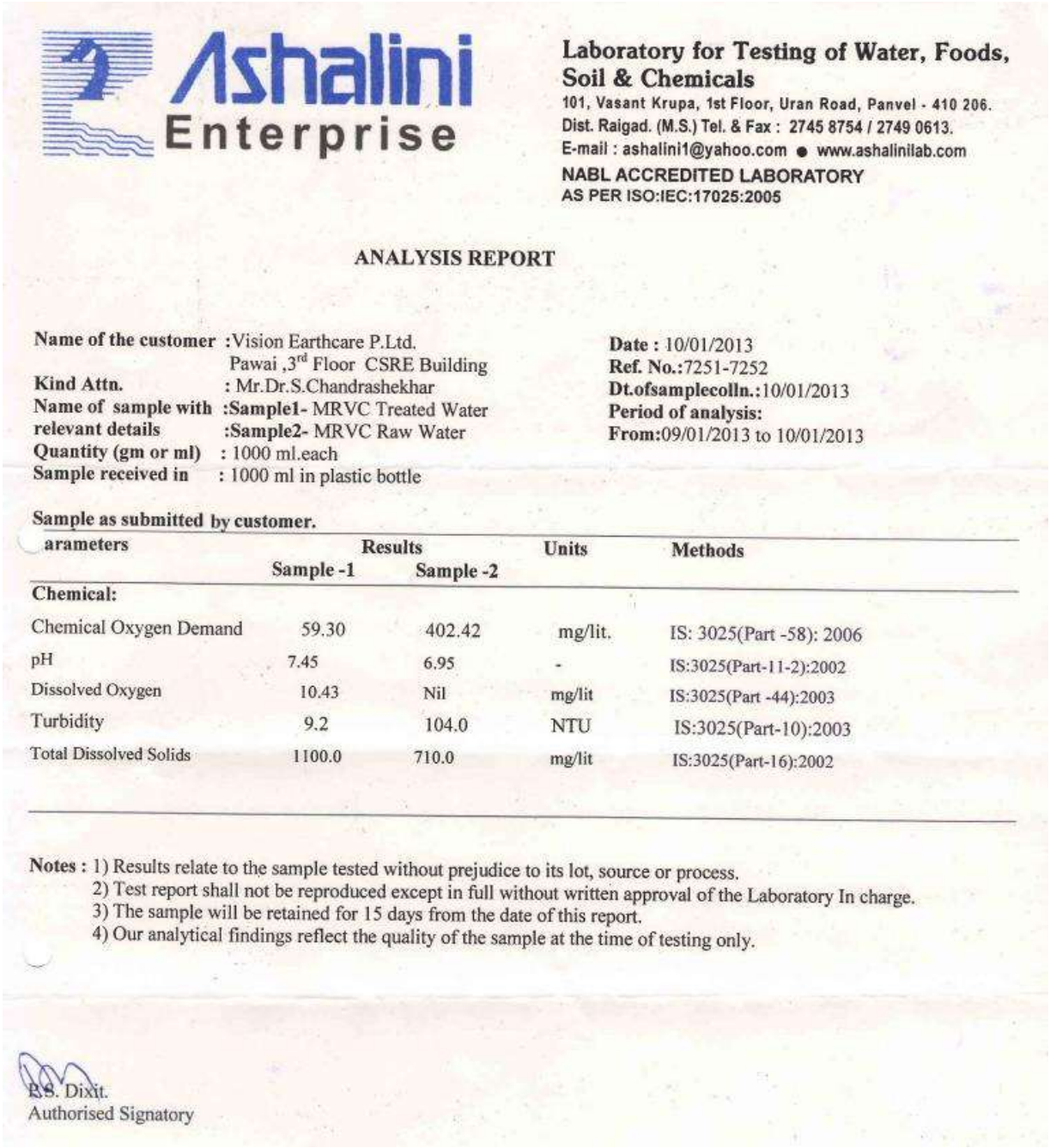
Fig 4.2: Scan of test certificate of Raw and treated water from Godrej Puducherry



Ashalini Enterprise

Laboratory for Testing of Water, Foods, Soil & Chemicals

101, Vasant Krupa, 1st Floor, Uran Road, Panvel - 410 206.
Dist. Raigad. (M.S.) Tel. & Fax : 2745 8754 / 2749 0613.
E-mail : ashalini1@yahoo.com ● www.ashalinilab.com
NABL ACCREDITED LABORATORY
AS PER ISO:IEC:17025:2005

ANALYSIS REPORT

Name of the customer :Vision Earthcare P.Ltd.
Pawai ,3rd Floor CSRE Building
Kind Attn. : Mr.Dr.S.Chandrashekhar
Name of sample with relevant details :**Sample1-** MRVC Treated Water
:**Sample2-** MRVC Raw Water
Quantity (gm or ml) : 1000 ml.each
Sample received in : 1000 ml in plastic bottle

Date : 10/01/2013
Ref. No.:7251-7252
Dt.ofsamplecolln.:10/01/2013
Period of analysis:
From:09/01/2013 to 10/01/2013

Sample as submitted by customer.

arameters	Results		Units	Methods
	Sample -1	Sample -2		
Chemical:				
Chemical Oxygen Demand	59.30	402.42	mg/lit.	IS: 3025(Part -58): 2006
pH	7.45	6.95	-	IS:3025(Part-11-2):2002
Dissolved Oxygen	10.43	Nil	mg/lit	IS:3025(Part -44):2003
Turbidity	9.2	104.0	NTU	IS:3025(Part-10):2003
Total Dissolved Solids	1100.0	710.0	mg/lit	IS:3025(Part-16):2002

Notes : 1) Results relate to the sample tested without prejudice to its lot, source or process.
2) Test report shall not be reproduced except in full without written approval of the Laboratory In charge.
3) The sample will be retained for 15 days from the date of this report.
4) Our analytical findings reflect the quality of the sample at the time of testing only.

R.S. Dixit.
Authorised Signatory

Fig 4.3: Scan of test certificate of raw and treated water from MRVC, Virar

उत्तर प्रदेश प्रदूषण नियंत्रण बोर्ड
UTTAR PRADESH POLLUTION CONTROL BOARD

संदर्भ सं० FT3524/के० प्रयोगा०/वि० आख्या प्रेषण/42/2012 दिनांक 05-12-12
Ref. No.

सेवा में,
वरिष्ठ प्रबंधक (अभि०–सिविल))
भारतीय विमानपत्तन प्राधिकरण
चौधरी चरण सिंह हवाई अड्डा
अमौसी, लखनऊ।

विषयः विश्लेषण आख्या प्रेषित किये जाने के संबंध में।

महोदय,

आपके पत्रांक भा0वि0प्रा0/लखनऊ प्रोजेक्ट/इंजी0–सिविल/टी0बी0/एस.टी.पी. 2012–13/7347–50 दिनांक 30.10.12 द्वारा प्रेषित उत्प्रवाह के 02 नमूनें (रॉ इफ्लूएन्ट, ट्रीटेट इफ्लूएन्ट) विश्लेषण हेतु प्राप्त हुए थे जिसकी विश्लेषण आख्या संलग्न कर प्रेषित की जा रही है।

संलग्नकः उपरोक्तानुसार।

भवदीया

(डा० मधु भारद्वाज)
मुख्य पर्यावरण अधिकारी
केन्द्रीय प्रयोगशाला

TEST REPORT: WASTE WATER LABORATORY

of compilation of test report 22/11/12 Dt./period of testing 30/10/12 to 9/11/12

1. इन्डस्ट्री का नाम एवं पता / Name and Address of Industry Sewage Treatment Plant– Chaudhary Charan Singh Air Port, Lucknow
2. नमूने का प्रकार (ग्रैब/कम्पोजिट/इन्टिग्रेटेड) / Type of Sample (Grab/Composite/Integrated) Grab
3. नमूने एकत्र करने वाले व्यक्ति का विवरण / Sample Collected by Airport Authority of India, Chaudhary Charan Singh Air Port–, Lucknow
4. एकत्रित नमूने का रंग एवं गंध / Colour & Odour —
5. एकत्रित नमूने की मात्रा एवं पैकिंग / Quantity & Packing (Plastic Jerican/Any Other) 2 Lit
6. नमूने एकत्रीकरण की तिथि / Date of Sample Collection 30/10/12
7. विश्लेषण हेतु आवेदनकर्ता / Analysis indented by Airport Authority of India, C.S.S. Airport Lucknow
8. प्रयोगशाला में नमूना प्राप्ति की तिथि / Date of Sample receipt in Laboratory 30/10/12
9. विश्लेषण विधि हेतु कृ.प.उ. / Test methods followed are appended overleaf.

क्र० सं० / S.No.	पैरामीटर / Parameter	इकाई / Unit	नमूनों का प्रयोगशाला कोड/नमूना एकत्रण स्थल Sample Code No./Sampling Point UPPCB/C-L/WW/626A+B/12 Raw Effluent
1	पी. एच/pH	-	6.97
2	सस्पेन्डेड सॉलिड / Suspended Solids	मिग्रा/ली. / mg/l	486.0
3	टोटल डिसॉल्व्ड सॉलिड / Total Dissolved Solids	मिग्रा/ली. / mg/l	-
4	टोटल सॉलिड / Total Solids	मिग्रा/ली. / mg/l	-
5	क्लोराइड / Chloride Cl^-	मिग्रा/ली. / mg/l	-
6	फ्लोराइड / Fluoride as F^-	मिग्रा/ली. / mg/l	-
7	सल्फेट / Sulphate as SO_4^{2-}	मिग्रा/ली. / mg/l	-
8	फॉस्फेट-पी. / Phosphate-P	मिग्रा/ली. / mg/l	-
9	अमोनिकल नाइट्रोजन / Ammonical Nitrogen	मिग्रा/ली. / mg/l	-
10	नाइट्रेट–नाइट्रोजन / Nitrate-Nitrogen	मिग्रा/ली. / mg/l	-
11	सोडियम / Sodium Na	मिग्रा/ली. / mg/l	-
12	पोटेशियम / Potassium K	मिग्रा/ली. / mg/l	-
13	बी.ओ.डी. / BOD 3 day 27°C	मिग्रा/ली. / mg/l	720.0
14	सी.ओ.डी. / COD	मिग्रा/ली. / mg/l	2400.0
15	क्रोमियम हेक्सावेलेन्ट / Chromium Hexavalent $/Cr^{+6}$	मिग्रा/ली. / mg/l	-
16	टोटल क्रोमियम / Total Chromium / T.Cr	मिग्रा/ली. / mg/l	-
17	कॉपर / Copper /Cu	मिग्रा/ली. / mg/l	-
18	कैडमियम / Cadmium / Cd	मिग्रा/ली. / mg/l	-
19	लेड / Lead / Pb	मिग्रा/ली. / mg/l	-
20	आयरन / Iron / Fe	मिग्रा/ली. / mg/l	-
21	निकिल / Nickel / Ni	मिग्रा/ली. / mg/l	-
22	जिंक / Zinc / Zn	मिग्रा/ली. / mg/l	-
23	Oil and Grease	mg/l	8.0

परीक्षण करने वाले के हस्ताक्षर/Analysed by Rita Tyagi 22/11/12 Preeti B. 22/11/12
अधिकृत हस्ताक्षरकर्ता/Auth- Signatory Madhu Bhardwaj 22/11/2012
मुख्य पर्यावरण अधिकारी/टेक्निकल मैनेजर/CEO/T.M

TEST REPORT: WASTE WATER LABORATORY

of compilation of test report 22/11/12 Dt./period of testing 30/10/12 to 9/11/12

1. इन्डस्ट्री का नाम एवं पता / Name and Address of Industry Sewage Treatment Plant– Chaudhary Charan Singh Airport, Lucknow
2. नमूने का प्रकार (ग्रैब/कम्पोजिट/इन्टिग्रेटेड) / Type of Sample (Grab/Composite/Integrated) Grab
3. नमूने एकत्र करने वाले व्यक्ति का विवरण / Sample Collected by Air port Authority of India, Chaudhary Charan Singh Airport, Lucknow
4. एकत्रित नमूने का रंग एवं गंध / Colour & Odour —
5. एकत्रित नमूने की मात्रा एवं पैकिंग / Quantity & Packing (Plastic Jerican/Any Other) 2 Lit
6. नमूने एकत्रीकरण की तिथि / Date of Sample Collection 30/10/12
7. विश्लेषण हेतु आवेदनकर्ता / Analysis indented by Airport Authority of India, C.S.S. Airport Lucknow
8. प्रयोगशाला में नमूना प्राप्ति की तिथि / Date of Sample receipt in Laboratory 30/10/12
9. विश्लेषण विधि हेतु कृ.प.उ. / Test methods followed are appended overleaf.

क्र० सं० / S.No.	पैरामीटर / Parameter	इकाई / Unit	नमूनों का प्रयोगशाला कोड/नमूना एकत्रण स्थल Sample Code No./Sampling Point UPPCB/C-L/WW/626A+B/12 Treated Effluent
1	पी. एच/pH	-	7.08
2	सस्पेन्डेड सॉलिड / Suspended Solids	मिग्रा/ली. / mg/l	46.0
3	टोटल डिसॉल्व्ड सॉलिड / Total Dissolved Solids	मिग्रा/ली. / mg/l	-
4	टोटल सॉलिड / Total Solids	मिग्रा/ली. / mg/l	-
5	क्लोराइड / Chloride Cl^-	मिग्रा/ली. / mg/l	-
6	फ्लोराइड / Fluoride as F^-	मिग्रा/ली. / mg/l	-
7	सल्फेट / Sulphate as SO_4^{2-}	मिग्रा/ली. / mg/l	-
8	फॉस्फेट-पी. / Phosphate-P	मिग्रा/ली. / mg/l	-
9	अमोनिकल नाइट्रोजन / Ammonical Nitrogen	मिग्रा/ली. / mg/l	-
10	नाइट्रेट–नाइट्रोजन / Nitrate-Nitrogen	मिग्रा/ली. / mg/l	-
11	सोडियम / Sodium Na	मिग्रा/ली. / mg/l	-
12	पोटेशियम / Potassium K	मिग्रा/ली. / mg/l	-
13	बी.ओ.डी. / BOD 3 day 27°C	मिग्रा/ली. / mg/l	35.0
14	सी.ओ.डी. / COD	मिग्रा/ली. / mg/l	92.0
15	क्रोमियम हेक्सावेलेन्ट / Chromium Hexavalent $/Cr^{+6}$	मिग्रा/ली. / mg/l	-
16	टोटल क्रोमियम / Total Chromium / T.Cr	मिग्रा/ली. / mg/l	-
17	कॉपर / Copper /Cu	मिग्रा/ली. / mg/l	-
18	कैडमियम / Cadmium / Cd	मिग्रा/ली. / mg/l	-
19	लेड / Lead / Pb	मिग्रा/ली. / mg/l	-
20	आयरन / Iron / Fe	मिग्रा/ली. / mg/l	-
21	निकिल / Nickel / Ni	मिग्रा/ली. / mg/l	-
22	जिंक / Zinc / Zn	मिग्रा/ली. / mg/l	-
23	Oil and Grease	mg/l	Nil

परीक्षण करने वाले के हस्ताक्षर/Analysed by Rita Tyagi 22/11/12 Preeti B. 22/11/12
अधिकृत हस्ताक्षरकर्ता/Auth- Signatory Madhu Bhardwaj 22/11/2012
मुख्य पर्यावरण अधिकारी/टेक्निकल मैनेजर/CEO/T.M

Fig 4.4: Scan of test certificate of raw and treated water from AAI, Lucknow.

BANGALORE TEST HOUSE

65, 20th Main, Marenahalli,
Vijayanagar, Bangalore - 560 040.
Ph.: 23356415, 23388895, 23502689 Fax : 080-23385979
e-mail : testhouse@satyam.net.in website : www.bthindia.com

ISO 9001-2008

TEST CERTIFICATE

1 of 1

M/s. Vision Earthcare Pvt. Ltd.,
SINE, 3rd Floor, CSRE Building,
IIT Bombay,
MUMBAI – 400 076.

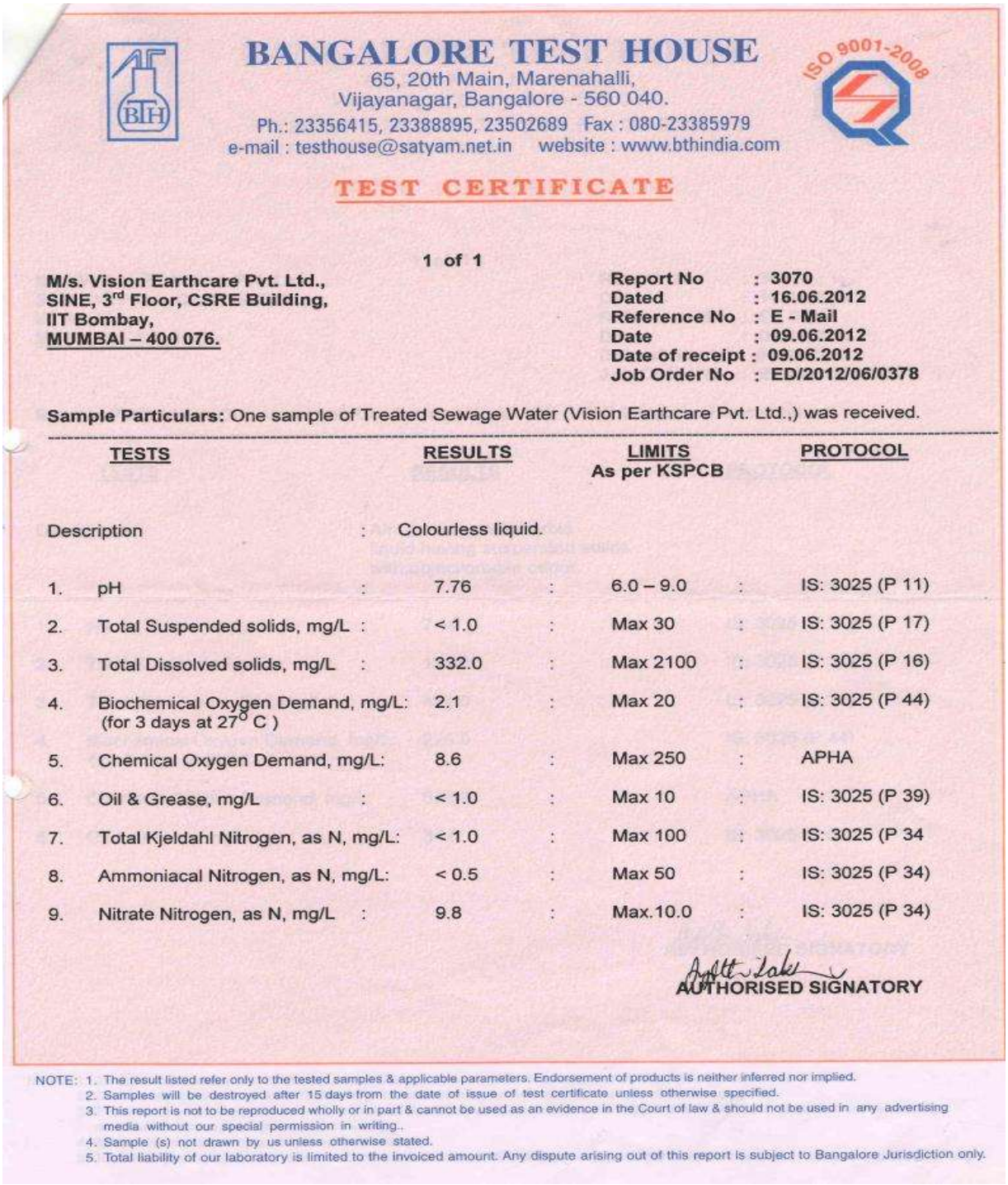
Report No : 3069
Dated : 16.06.2012
Reference No : E - Mail
Date : 09.06.2012
Date of receipt : 09.06.2012
Job Order No : ED/2012/06/0377

Sample Particulars: One sample of Raw Sewage Water (GE CHAF Bangalore) was received.

	TESTS		RESULTS		PROTOCOL
Description		:	Almost colourless turbid liquid having suspended solids with objectionable odour.		
1.	pH	:	7.14	:	IS: 3025 (P 11)
2.	Total Suspended solids, mg/L	:	180.0	:	IS: 3025 (P 17)
3.	Total Dissolved solids, mg/L	:	484.0	:	IS: 3025 (P 16)
4.	Biochemical Oxygen Demand, mg/L: (for 3 days at 27° C)		225.0	:	IS: 3025 (P 44)
5.	Chemical Oxygen Demand, mg/L:		585.8	:	APHA
6.	Oil & Grease, mg/L	:	34.0	:	IS: 3025 (P 39)

AUTHORISED SIGNATORY

NOTE: 1. The result listed refer only to the tested samples & applicable parameters. Endorsement of products is neither inferred nor implied.
2. Samples will be destroyed after 15 days from the date of issue of test certificate unless otherwise specified.
3. This report is not to be reproduced wholly or in part & cannot be used as an evidence in the Court of law & should not be used in any advertising media without our special permission in writing..
4. Sample (s) not drawn by us unless otherwise stated.
5. Total liability of our laboratory is limited to the invoiced amount. Any dispute arising out of this report is subject to Bangalore Jurisdiction only.



BANGALORE TEST HOUSE

65, 20th Main, Marenahalli,
Vijayanagar, Bangalore - 560 040.
Ph.: 23356415, 23388895, 23502689 Fax : 080-23385979
e-mail : testhouse@satyam.net.in website : www.bthindia.com

ISO 9001-2008

TEST CERTIFICATE

1 of 1

M/s. Vision Earthcare Pvt. Ltd.,
SINE, 3rd Floor, CSRE Building,
IIT Bombay,
MUMBAI – 400 076.

Report No : 3070
Dated : 16.06.2012
Reference No : E - Mail
Date : 09.06.2012
Date of receipt : 09.06.2012
Job Order No : ED/2012/06/0378

Sample Particulars: One sample of Treated Sewage Water (Vision Earthcare Pvt. Ltd.,) was received.

	TESTS	RESULTS	LIMITS As per KSPCB	PROTOCOL
	Description :	Colourless liquid.		
1.	pH :	7.76 :	6.0 – 9.0 :	IS: 3025 (P 11)
2.	Total Suspended solids, mg/L :	< 1.0 :	Max 30 :	IS: 3025 (P 17)
3.	Total Dissolved solids, mg/L :	332.0 :	Max 2100 :	IS: 3025 (P 16)
4.	Biochemical Oxygen Demand, mg/L: (for 3 days at 27° C)	2.1 :	Max 20 :	IS: 3025 (P 44)
5.	Chemical Oxygen Demand, mg/L:	8.6 :	Max 250 :	APHA
6.	Oil & Grease, mg/L :	< 1.0 :	Max 10 :	IS: 3025 (P 39)
7.	Total Kjeldahl Nitrogen, as N, mg/L:	< 1.0 :	Max 100 :	IS: 3025 (P 34
8.	Ammoniacal Nitrogen, as N, mg/L:	< 0.5 :	Max 50 :	IS: 3025 (P 34)
9.	Nitrate Nitrogen, as N, mg/L :	9.8 :	Max.10.0 :	IS: 3025 (P 34)

AUTHORISED SIGNATORY

NOTE:
1. The result listed refer only to the tested samples & applicable parameters. Endorsement of products is neither inferred nor implied.
2. Samples will be destroyed after 15 days from the date of issue of test certificate unless otherwise specified.
3. This report is not to be reproduced wholly or in part & cannot be used as an evidence in the Court of law & should not be used in any advertising media without our special permission in writing..
4. Sample (s) not drawn by us unless otherwise stated.
5. Total liability of our laboratory is limited to the invoiced amount. Any dispute arising out of this report is subject to Bangalore Jurisdiction only.

Fig 4.5: Scan of test certificate of raw and treated water from Command Hospitals, Chief Engineer Air Force, Bangalore

5. Details of Certification of CAMUS-SBT

An application for evaluation of CAMUS-SBT technology submitted to Bureau of Indian Standards. A meeting is anticipated shortly. A copy of the front page of US patents (6890438B2/7604742B2) is shown in Figure 5.1 and Figure 5.2. A scan of IIT Bombay certification letter is shown in Figure 5.3

US006890438B2

(12) **United States Patent**
Shankar et al.

(10) **Patent No.: US 6,890,438 B2**
(45) **Date of Patent: May 10, 2005**

(54) **PROCESS FOR TREATMENT OF ORGANIC WASTES**

(75) Inventors: **Hariharan S. Shankar**, Mumbai (IN); **Biplab R. Pattanaik**, Cuttack (IN); **Uday S. Bhawalkar**, Pune (IN)

(73) Assignee: **Indian Institute of Technology Bombay**, Mumbai (IN)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 5 days.

(21) Appl. No.: **10/425,289**

(22) Filed: **Apr. 28, 2003**

(65) **Prior Publication Data**

US 2004/0065610 A1 Apr. 8, 2004

(30) **Foreign Application Priority Data**

Apr. 26, 2002 (IN) 384/MUM/2002
Apr. 26, 2002 (IN) 383/MUM/2002

(51) **Int. Cl.**[7] **C02F 3/32**; C05F 1/00; C05F 5/00; C05F 7/00; C05F 8/00

(52) **U.S. Cl.** **210/602**; 210/610; 210/620; 119/6.7; 71/11; 71/14; 71/21

(58) **Field of Search** 210/602, 620, 210/610, 611, 631; 435/290.1; 119/6.7; 71/11, 14, 21

(56) **References Cited**

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(Continued)

Primary Examiner—Fred G. Prince
(74) *Attorney, Agent, or Firm*—Morrison & Foerster LLP

(57) **ABSTRACT**

A process for conversion of organic wastes into biofertilizers

Fig. 5.1: Scan Front Page of US Patent 6890348B2 Document

(12) **United States Patent**
Shankar et al.

(10) **Patent No.: US 7,604,742 B2**
(45) **Date of Patent: Oct. 20, 2009**

(54) **SOIL CONDITIONING PRODUCTS FROM ORGANIC WASTE**

(75) Inventors: **Hariharan S. Shankar**, Mumbai (IN); **Biplab R. Pattanaik**, Cuttack (IN); **Uday S. Bhawalkar**, Pune (IN)

(73) Assignee: **Indian Institute of Technology Bombay**, Mumbai (IN)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 349 days.

(21) Appl. No.: **11/125,748**

(22) Filed: **May 9, 2005**

(65) **Prior Publication Data**

US 2005/0210941 A1 Sep. 29, 2005

Related U.S. Application Data

(63) Continuation of application No. 10/425,289, filed on Apr. 28, 2003, now Pat. No. 6,890,438.

(30) **Foreign Application Priority Data**

Apr. 26, 2002 (IN) 383/MUM/2002
Apr. 26, 2002 (IN) 384/MUM/2002

(51) **Int. Cl.**
C02F 3/32 (2006.01)
C05F 1/00 (2006.01)
C05F 5/00 (2006.01)
C05F 7/00 (2006.01)

(52) **U.S. Cl.** **210/602**; 210/610; 210/620; 119/6.7; 71/11; 71/14; 71/21

(58) **Field of Classification Search** 210/602, 210/620, 610, 611, 631; 435/290.1; 119/6.7; 71/11, 14, 21

See application file for complete search history.

(56) **References Cited**

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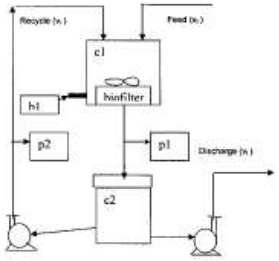
(Continued)

Primary Examiner—Fred Prince
(74) *Attorney, Agent, or Firm*—Morrison & Foerster LLP

(57) **ABSTRACT**

A process for conversion of organic wastes into biofertilizers such as soil conditioning agents of fertilizer grade, culture grade and soil grade is provided. Also provided is a process for conversion of organic wastes into material for converting waste water into reusable water. The invention provides methods for conversion of organic solid wastes to biofertilizers and reusable water in the presence of a geophagus earthworm *Pheretima elongata* culure to produce a variety of valuable soil conditioning products and reusable water.

32 Claims, 3 Drawing Sheets



Schematics of biofilter operation

Fig. 5.2: Scan Front Page of US Patent 7604742B2 Document

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Extn. : 7031, 7039 (O)
Fax : (+91-22) 2572 3702
Email : adeanrnd@iitb.ac.in
Website : www.iitb.ac.in

IIT Bombay

प्रा. के. कुरीयन आयसैक
सह संकायाध्यक्ष (अ एवं वि)
Prof. K. Kurien Issac
Associate Dean (R & D)

To whomsoever it may concern

This is to inform that M/s Vision Earthcare Pvt Ltd. is a company, which is being incubated in the Society for Innovation and Entrepreneurship (SINE) at IIT Bombay, towards promotion, marketing, sales, support and services in connection with Soil Biotechnology, developed by Prof.H.S.Shankar, Chemical Engg. Deptt and his students at IIT Bombay.

Two Indian patents have been granted to IIT Bombay in this regard (Patent Nos.203744 on Process for Waste Water Renovation and 203425 on Process for Treatment of Organic Solid Waste both filed on 26 April 2002) and permission has been given to Vision Earthcare Pvt Ltd. to commercialise this technology. Enquiries to Vision Earthcare Pvt. Ltd. related to the use/commercialisation of the technology need not be routed through IIT Bombay.

Also, a US patent 6,890,438 B2 on "Processes for treatment of organic wastes" was granted to IITB on May 10, 2005.

21/02/08

Associate Dean Research and Development
Indian Institute of Technology Bombay

Dated: 21 February 2008

Fig. 5.3: Scan copy of IIT Bombay Letter.

6. Advantages of the CAMUS-SBT as Compared to Other STP Technologies

1. CAMUS-SBT uses only natural materials and it is 100% ecological.

2. CAMUS-SBT allows user start-stop mode of operation and the plant can be run in intermittent mode, batch mode and continuous mode as per site conditions allowing 100% mission availability under varying conditions.

3. CAMUS-SBT can easily handle 150% peak loads for a few days by increasing running times as the situation demands.

4. CAMUS-SBT is capable of tertiary treatment (removal of Nitrogen, Phosphorous and heavy metals). Treated water is antiseptic due to high Dissolved Oxygen levels unlike other treatment technologies.

5. Most other technologies require users to ship the sludge generated to a disposal station such as a land fill at significant cost not to mention much hassle. CAMUS-SBT avoids sludge generation and treats all of it within the process itself. However a provision for a bio-fertilizer from the process can be arranged should the customer need such a facility for other landscaping use.

6. One unique aspect of CAMUS-SBT is the incremental improvement in output water quality as the bioreactor beds adjust to the specific influent composition from process. A 10 year old CAMUS-SBT plant will routinely deliver superior performance than a new plant. All this with little external input.

7. No moving parts unlike MBBR, MBR, and Activated sludge process based STP's numerous motors, stirrers, blowers, clarifier's pumps etc.

8. Easy to operate, it can be operated by gardener rather than engineer. The plant displays of high aesthetics and appears like garden.

9. Low depreciation because of less mechanical equipment.

10. Conventional treatment plants create a very bad working environment with many noxious fumes. They therefore have to be sited far away from living and working spaces. CAMUS-SBT is completely odorless and the output water is reusable.

11. In CAMUS-SBT plants treating normal sewage, the output water is exceptionally good quality.

7. Manufacturers of CAMUS-SBT

CAMUS-SBT process and its technological advancement have been developed by Prof HSShankar during 2007-11. Any Enquiries for CAMUS SBT process can be addressed to hss@iitb.ac.in and hssiitb@gmail.com

8. Present Usage of CAM US-SBT

Table 8.1: Clients list

Client	Place	Capacity (KLD)	Year
Naval Dockyard	Bombay	10	2000
Naval Housing Colony	Bombay	200	2001
Jindal Steel	Delhi	150	2003
Bombay Presidency Golf Club	Bombay	1000	2003
Mughal Sheraton	Agra	250	2003
TajKiran	Gwalior	150	2003
Vazir Sultan Tobacco	Hyderabad	150	2004
University of Hyderabad	Hyderabad	200	2005
IIT Bombay	Mumbai	30	2006
Bombay Muncipal Corporation	Mumbai	3000	2006
MaharanaPratap Air port	Udaipur	120	2007
VanvasiKalyan Ashram	Mangoan	50	2008
Godrej Coil-9	Pondicherry	30	2009
Shamik builders	Lonavala	50	2009
Nature Trail, Lavasa	Pune	10	2009
FRLHT Ayurvedic hospital	Bangalore	95	2009-10
ACCEPT AIDS care society	Bangalore	15	2009-10
KalyanDombivliMuncipal Corp.	Mumbai	3000	2009-10
Ship Building center	Vishakhapatnam	20	2009-10
Command Hospital	Bangalore	250	2010-11
Coffee estate	Chikmangaloor	20	2010-11
Visaka Industries	Nagpur	30	2010-11
Instapower Industries	Roorkee	5	2010-11
Navneet Industries	Silvassa	10	2010-11
Mumbai Railway Vikas Corporation	Mumbai-Virar	40	2011-12
ChowdaryCharan Singh Airport	Lucknow	160	2011-12
Bombay Presidency Golf Club	Bombay	250	2011-12
Housing Development & Infrastructure Ltd.	Mumbai-Virar	650	2012-13
Royal Resorts Pvt. Ltd.	Udaipur	30	2012-13
Air Force South West Command	Chiloda	1400	2012-13
Army, South west command	Jaisalmer	1400	2012-13

9. Users of CAMUS-SBT in Govt. Bodies

Table 9.1: Clients in MES/other Govt. Departments

Client	Place	Capacity(KLD)	Year
Naval Dockyard	Bombay	10	2000
Naval Housing Colony	Bombay	200	2001
University of Hyderabad	Hyderabad	200	2005
IIT Bombay	Mumbai	30	2006
Bombay Municipal Corporation	Mumbai	3000	2006
Maharana Pratap Air port	Udaipur	120	2007
Kalyan Dombivli Muncipal Corp.	Mumbai	3000	2009
Ship Building Center	Vishakhapatnam	20	2009
Command Hospital Air Force	Bangalore	250	2010
Mumbai Railway Vikas Corporation	Mumbai-Virar	40	2011
Chowdary Charan Singh Airport	Lucknow	160	2011
Air Force South West Command	Chiloda	1400	2012-13
Army, South west command	Jaisalmer	1400	2012-13

10. CAMUS-SBT Profile

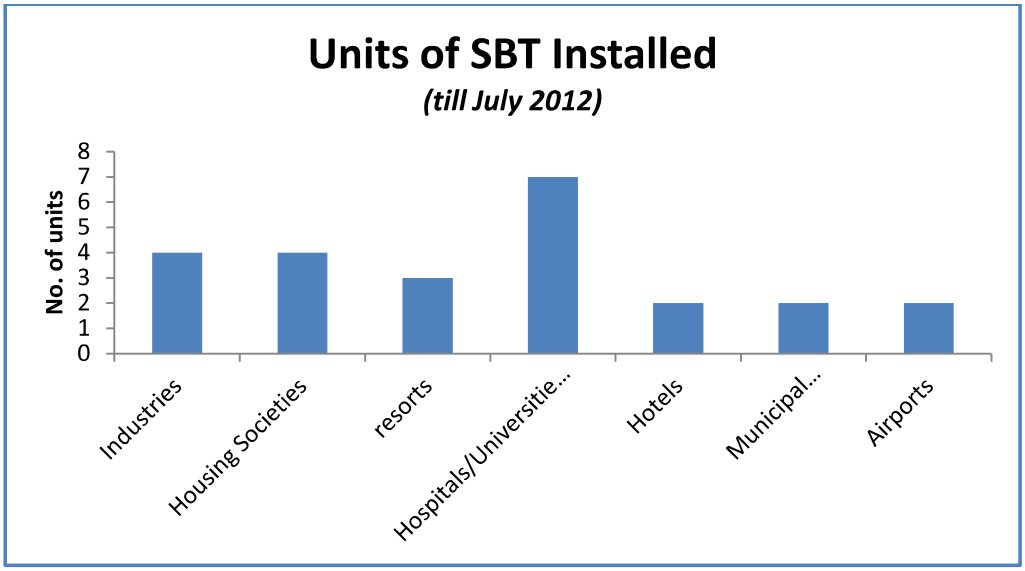


Fig10.1: Sector wise profile for no of units of CAMUS-SBT technology

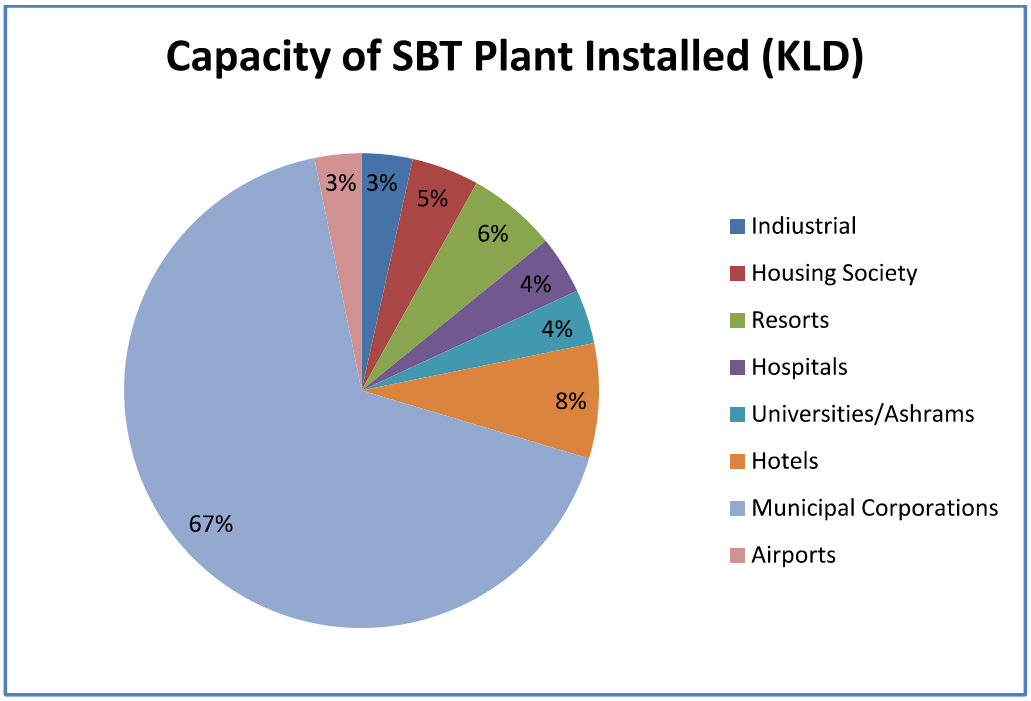


Fig 10.2: Sector wise profile for installed capacity (KLD) of CAMUS-SBT technology

11. List of earlier approvals by MES/other Govt. Departments

MUNICIPAL CORPORATION OF GREATER MUMBAI

Office of:
Executive Engineer Mechanical
(Sewerage) City-II
Love Grove W.W.T.F.,
89, Dr. Annie Besant Road,
Worli, Mumbai 400 018

TO WHOMSOEVER IT MAY CONCERN

The Municipal Corporation of Greater Mumbai (MCGM) has built a wastewater recycling plant at Love Grove WWTF; Worli based on the Soil Bio Technology (SBT) developed by IIT, Bombay, and has been functional since June 2006. Prof. H. S. Shankar of Chemical Engineering Department of IIT Bombay, the inventor of the technology, was the consultant for setting up this SBT Plant.

The installed capacity of this SBT plant is 30 lacs liters per day and it consists of two reactor beds and a water holding tank over total area of 5000 square meters.

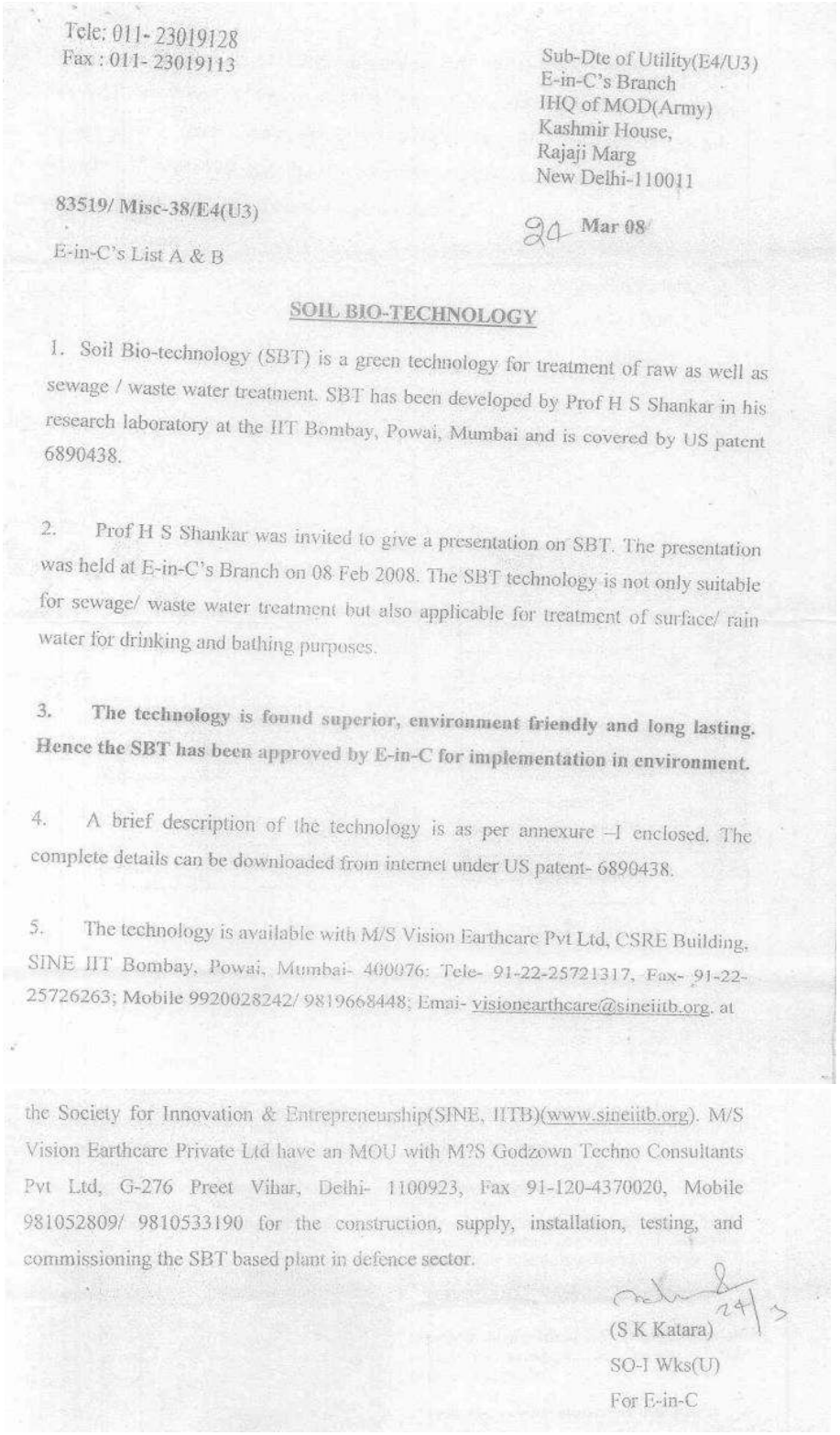
The SBT plant is producing recycled water of very good quality suitable for various non-potable applications.

M/s Vision Earthcare Pvt. Ltd. have carried out operation and maintenance of SBT plant satisfactorily for a period of one year and have also successfully provided and layed culture, Additives and 9B material required for periodic replenishment and restoration of the top layer of the SBT plant.

This letter is issued as per the request made by Prof. H.S. Shankar, vide his letter dated 3rd August 2009.

V. R. Vani
Executive Engineer Mechanical
(Sewerage) City-II

Fig 11.1: Scanned copy of approval from Municipal Corporation of Greater Mumbai.



Tele: 011- 23019128
Fax : 011- 23019113

Sub-Dte of Utility(E4/U3)
E-in-C's Branch
IHQ of MOD(Army)
Kashmir House,
Rajaji Marg
New Delhi-110011

83519/ Misc-38/E4(U3)

24 Mar 08

E-in-C's List A & B

SOIL BIO-TECHNOLOGY

1. Soil Bio-technology (SBT) is a green technology for treatment of raw as well as sewage / waste water treatment. SBT has been developed by Prof H S Shankar in his research laboratory at the IIT Bombay, Powai, Mumbai and is covered by US patent 6890438.

2. Prof H S Shankar was invited to give a presentation on SBT. The presentation was held at E-in-C's Branch on 08 Feb 2008. The SBT technology is not only suitable for sewage/ waste water treatment but also applicable for treatment of surface/ rain water for drinking and bathing purposes.

3. **The technology is found superior, environment friendly and long lasting. Hence the SBT has been approved by E-in-C for implementation in environment.**

4. A brief description of the technology is as per annexure –I enclosed. The complete details can be downloaded from internet under US patent- 6890438.

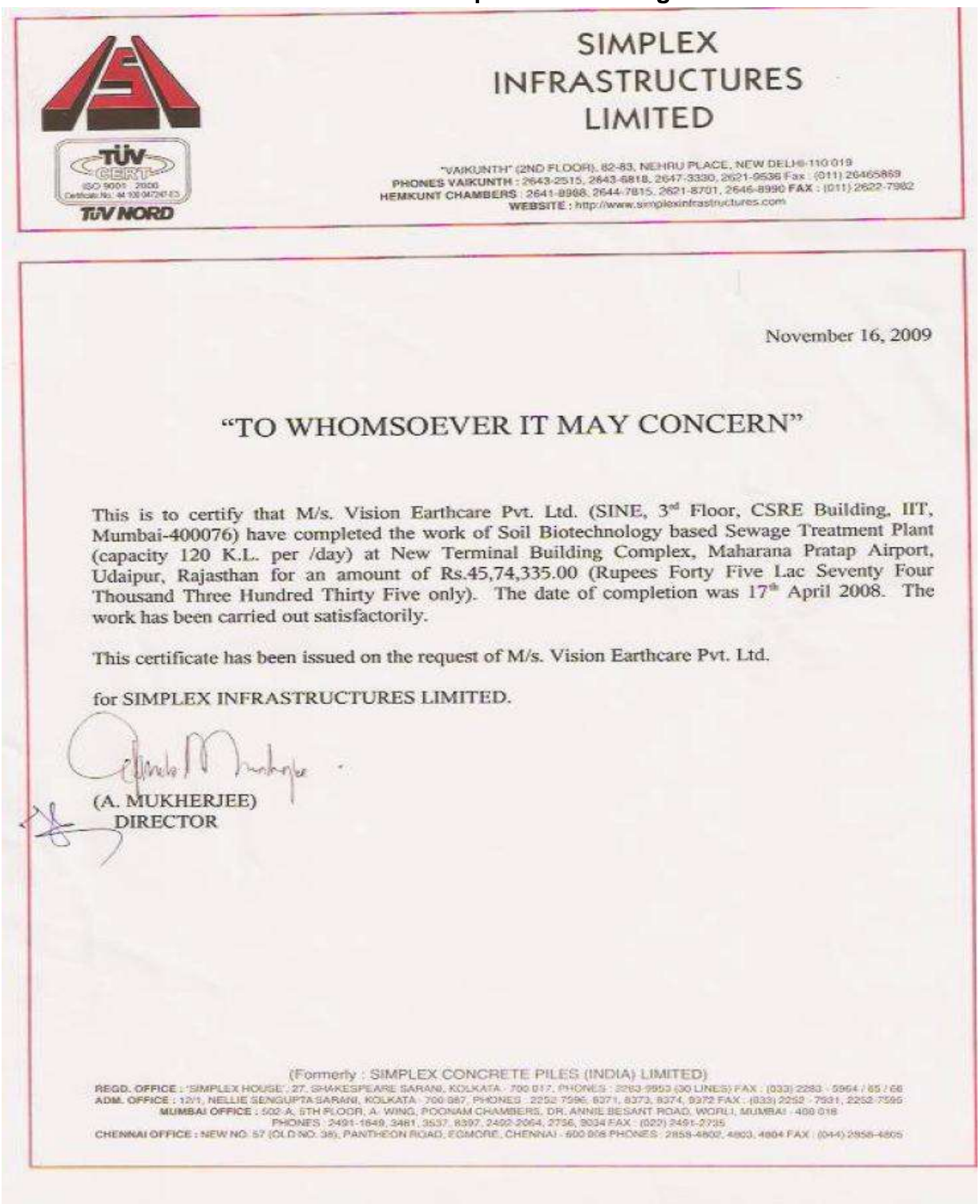
5. The technology is available with M/S Vision Earthcare Pvt Ltd, CSRE Building, SINE IIT Bombay, Powai, Mumbai- 400076; Tele- 91-22-25721317, Fax- 91-22-25726263; Mobile 9920028242/ 9819668448; Emai- visionearthcare@sineiitb.org, at the Society for Innovation & Entrepreneurship(SINE, IITB)(www.sineiitb.org). M/S Vision Earthcare Private Ltd have an MOU with M?S Godzown Techno Consultants Pvt Ltd, G-276 Preet Vihar, Delhi- 1100923, Fax 91-120-4370020, Mobile 981052809/ 9810533190 for the construction, supply, installation, testing, and commissioning the SBT based plant in defence sector.

24/3

(S K Katara)
SO-I Wks(U)
For E-in-C

Fig 11.2: Scan of approval from E-in-C Branch, IHQ (Army), Ministry of Defence GOI.

12. Feedback/ Performance Reports of Existing Clients



SIMPLEX INFRASTRUCTURES LIMITED

"VAIKUNTH" (2ND FLOOR), 82-83, NEHRU PLACE, NEW DELHI-110 019
PHONES VAIKUNTH : 2643-2515, 2643-6818, 2647-3330, 2621-9536 Fax : (011) 26465869
HEMKUNT CHAMBERS : 2641-8968, 2644-7815, 2621-8701, 2646-8990 FAX : (011) 2622-7982
WEBSITE : http://www.simplexinfrastructures.com

November 16, 2009

"TO WHOMSOEVER IT MAY CONCERN"

This is to certify that M/s. Vision Earthcare Pvt. Ltd. (SINE, 3rd Floor, CSRE Building, IIT, Mumbai-400076) have completed the work of Soil Biotechnology based Sewage Treatment Plant (capacity 120 K.L. per /day) at New Terminal Building Complex, Maharana Pratap Airport, Udaipur, Rajasthan for an amount of Rs.45,74,335.00 (Rupees Forty Five Lac Seventy Four Thousand Three Hundred Thirty Five only). The date of completion was 17th April 2008. The work has been carried out satisfactorily.

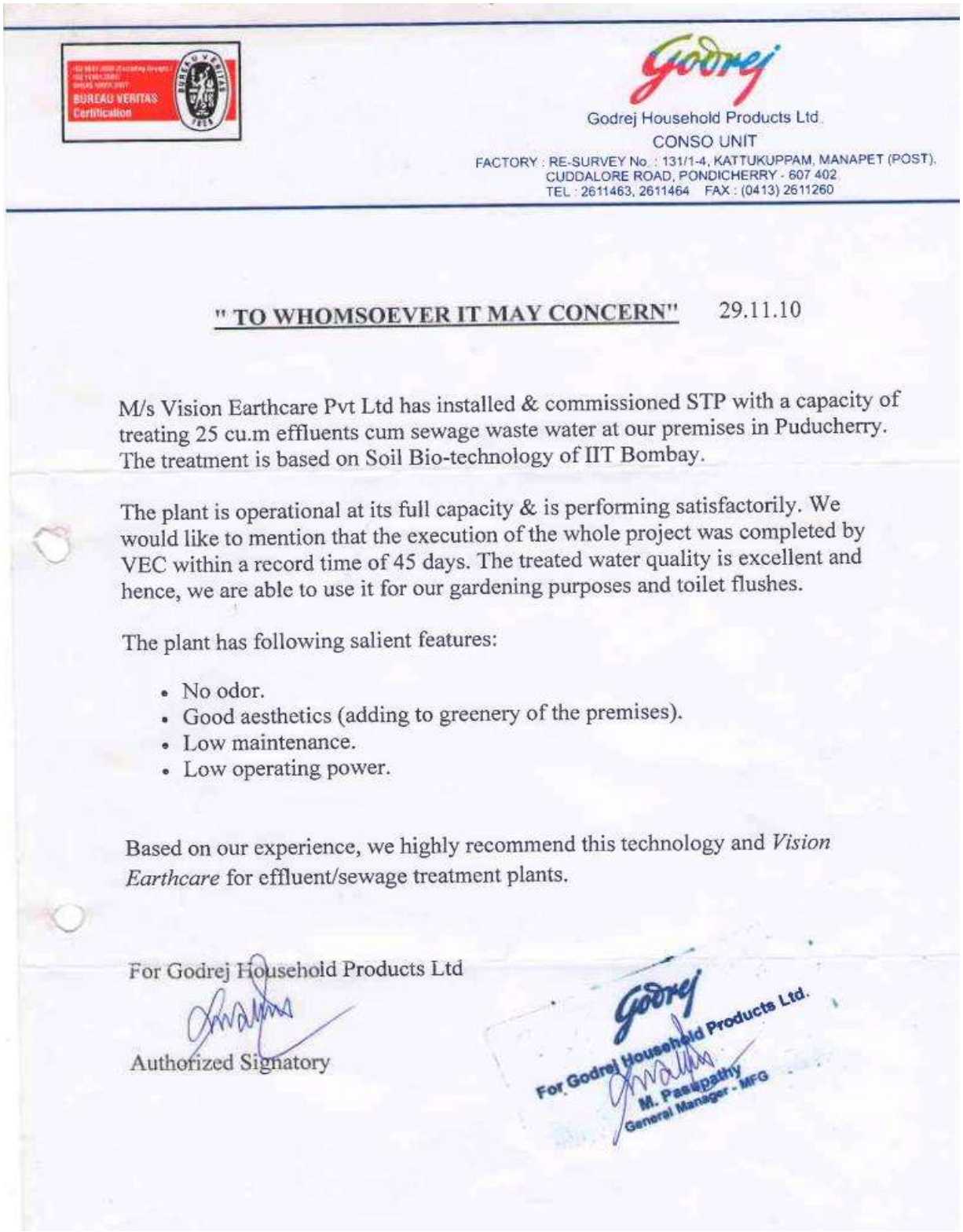
This certificate has been issued on the request of M/s. Vision Earthcare Pvt. Ltd.

for SIMPLEX INFRASTRUCTURES LIMITED.

(A. MUKHERJEE)
DIRECTOR

(Formerly : SIMPLEX CONCRETE PILES (INDIA) LIMITED)
REGD. OFFICE : "SIMPLEX HOUSE", 27, SHAKESPEARE SARANI, KOLKATA - 700 017. PHONES : 2283-9953 (30 LINES) FAX : (033) 2283 - 5964 / 65 / 66
ADM. OFFICE : 12/1, NELLIE SENGUPTA SARANI, KOLKATA - 700 087. PHONES : 2252 7596, 8371, 8373, 8374, 9372 FAX : (033) 2252 - 7931, 2252 7595
MUMBAI OFFICE : 502-A, 5TH FLOOR, A. WING, POONAM CHAMBERS, DR. ANNIE BESANT ROAD, WORLI, MUMBAI - 400 018
PHONES : 2491-1849, 3481, 3537, 8397, 2492-2064, 2756, 9034 FAX : (022) 2491-2735
CHENNAI OFFICE : NEW NO. 57 (OLD NO. 38), PANTHEON ROAD, EGMORE, CHENNAI - 600 008 PHONES : 2858-4802, 4803, 4804 FAX : (044) 2858-4805

Fig 12.1: Scan of feedback report from Maharana Pratap Airport, Udaipur, Rajasthan.



BUREAU VERITAS Certification

Godrej Household Products Ltd.
CONSO UNIT
FACTORY : RE-SURVEY No. : 131/1-4, KATTUKUPPAM, MANAPET (POST),
CUDDALORE ROAD, PONDICHERRY - 607 402
TEL : 2611463, 2611464 FAX : (0413) 2611260

" TO WHOMSOEVER IT MAY CONCERN" 29.11.10

M/s Vision Earthcare Pvt Ltd has installed & commissioned STP with a capacity of treating 25 cu.m effluents cum sewage waste water at our premises in Puducherry. The treatment is based on Soil Bio-technology of IIT Bombay.

The plant is operational at its full capacity & is performing satisfactorily. We would like to mention that the execution of the whole project was completed by VEC within a record time of 45 days. The treated water quality is excellent and hence, we are able to use it for our gardening purposes and toilet flushes.

The plant has following salient features:

- No odor.
- Good aesthetics (adding to greenery of the premises).
- Low maintenance.
- Low operating power.

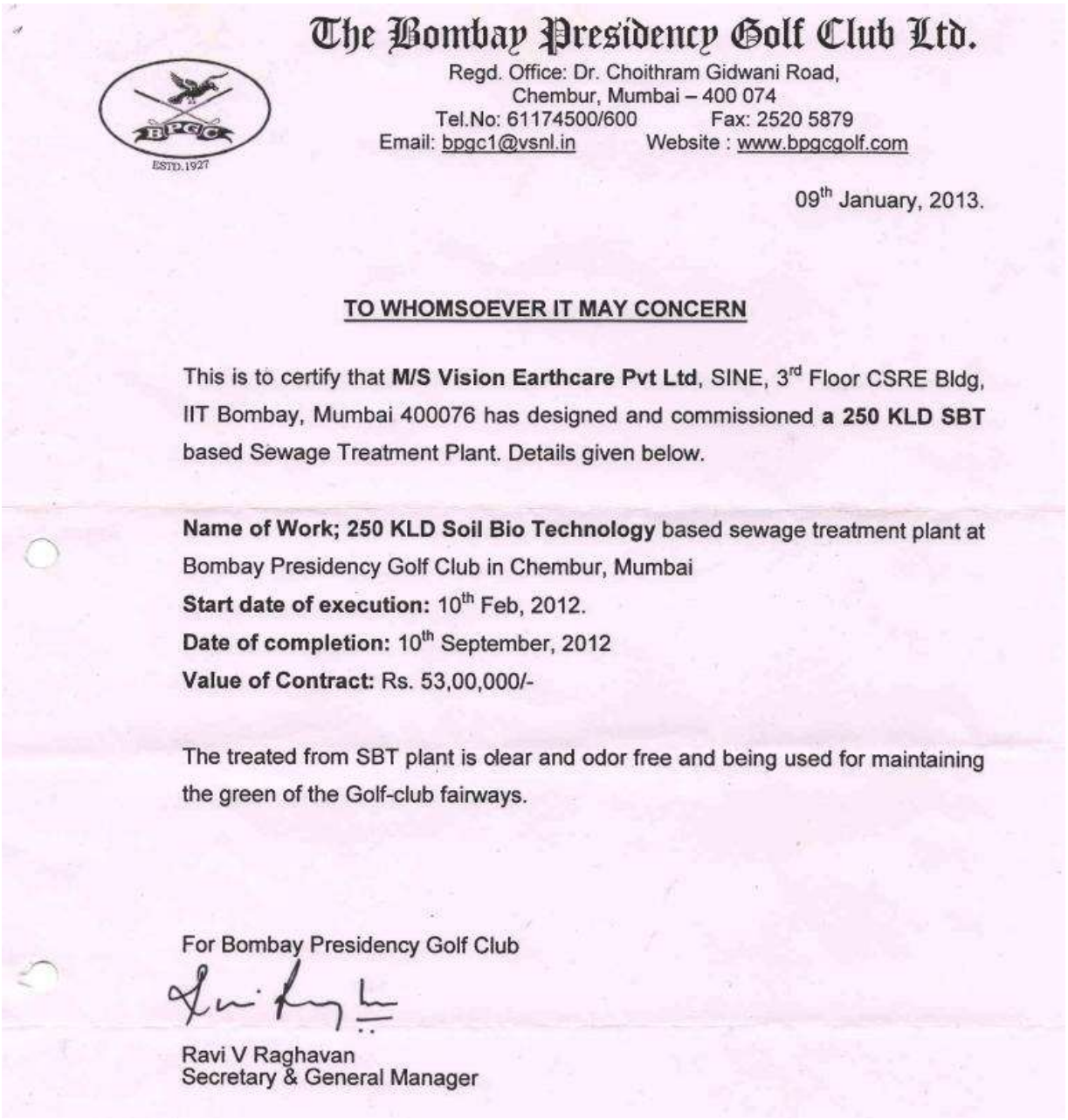
Based on our experience, we highly recommend this technology and *Vision Earthcare* for effluent/sewage treatment plants.

For Godrej Household Products Ltd

Authorized Signatory

For Godrej Household Products Ltd.
M. Pasupathy
General Manager - MFG

Fig 12.2: Scan of feedback report from Godrej, Pondicherry.



The Bombay Presidency Golf Club Ltd.

Regd. Office: Dr. Choithram Gidwani Road,
Chembur, Mumbai – 400 074
Tel.No: 61174500/600 Fax: 2520 5879
Email: bpgc1@vsnl.in Website : www.bpgcgolf.com

09th January, 2013.

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **M/S Vision Earthcare Pvt Ltd**, SINE, 3rd Floor CSRE Bldg, IIT Bombay, Mumbai 400076 has designed and commissioned **a 250 KLD SBT** based Sewage Treatment Plant. Details given below.

Name of Work; 250 KLD Soil Bio Technology based sewage treatment plant at Bombay Presidency Golf Club in Chembur, Mumbai
Start date of execution: 10th Feb, 2012.
Date of completion: 10th September, 2012
Value of Contract: Rs. 53,00,000/-

The treated from SBT plant is clear and odor free and being used for maintaining the green of the Golf-club fairways.

For Bombay Presidency Golf Club

Ravi V Raghavan
Secretary & General Manager

Fig 12.3: Scan of feedback report from BPGC, Mumbai.

AIRPORTS AUTHORITY OF INDIA
CHAUDHARY CHARAN SINGH AIRPORT
LUCKNOW

संदर्भ संख्या :– भाविप्रा/लखनऊ/इंजी(सि.)/एन.टी.बी/प्रोजेक्ट/WO-03/2012–13/ दिनाँक :–12.09.2012

TO WHOM IT MAY CONCERN

यह प्रमाणित किया जाता है कि **M/s Vision Earthcare Pvt. Ltd.** SINE 3rd Floor, CSRE Building, IIT Bombay, Powai, Mumbai-400076, द्वारा इस कार्यालय के अन्तर्गत निम्नलिखित कार्य, जिसका विवरण इस प्रकार है, पूर्ण किया है :–

1.	कार्य का नाम :–	**लखनऊ विमानक्षेत्र पर नए एकीकृत यात्री टर्मिनल भवन का निर्माण। उपशीर्ष:– सॉयल बायोटेक्नोलाजी आधारित सीवेज उपचार संयत्र का प्रावधान।**	
2.	अनुबंध संदर्भ संख्या :–भाविप्रा/लखनऊ/इंजी(सि.)/एन.टी.बी/प्रोजेक्ट/WO-03/5472-80, दिनांक : 07.02.2011		
3.	अनुबंध की लागत	:–	**रू0 67, 06, 650.00 (inclusive Rs. 838000/- for Operational & Maintenance for three years)**
4.	कार्य प्रारम्भ की तारीख	:–	24.09.2011
5.	कार्य समापन की तारीख	:–	23.11.2011
6.	कार्य की वास्तविक समापन की तारीख	:–	31.05.2012
7.	अन्तिम भुगतान धनराशि	:–	रू0 60,51,904.00**(exclusive Rs. 838000/- for Operational & Maintenance for three years)**
8.	ई0ओ0टी0	:–	**अनुमोदन बाकी है।**

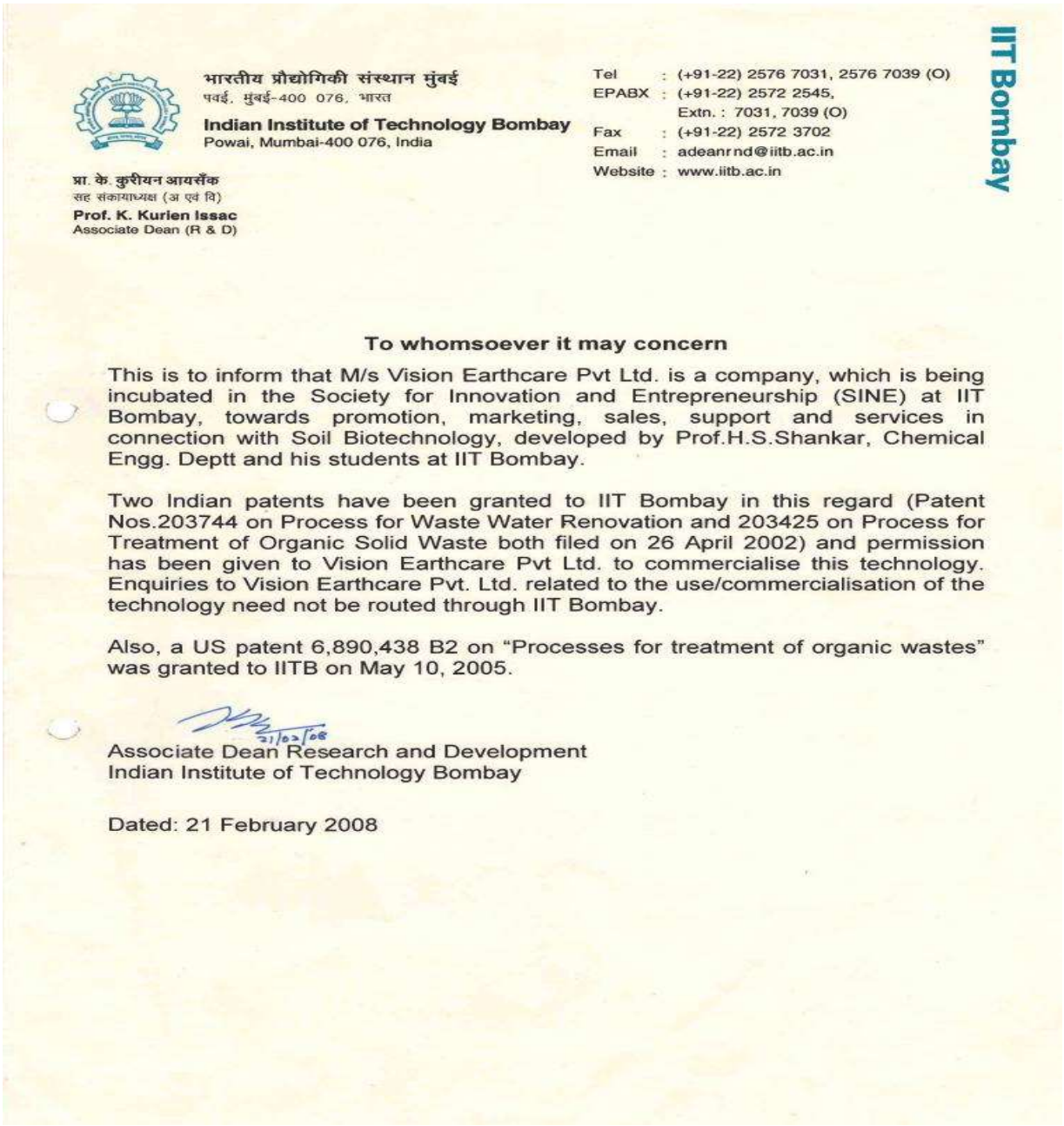
यह प्रमाण–पत्र फर्म के विशेष अनुरोध पर प्रदान किया गया है।

12/9/2012.

(जे0पी0 सिंह)
वरिष्ठ प्रबन्धक(इंजी–सिविल)
भा0वि0प्रा0, चौधरी चरण सिंह हवाईअड्डा, लखनऊ

Fig 12.4: Scan of feedback report from AAI, Lucknow.

13. Quality Assurance Patent Details



भारतीय प्रौद्योगिकी संस्थान मुंबई
पवई, मुंबई-400 076, भारत
Indian Institute of Technology Bombay
Powai, Mumbai-400 076, India

Tel : (+91-22) 2576 7031, 2576 7039 (O)
EPABX : (+91-22) 2572 2545,
Extn. : 7031, 7039 (O)
Fax : (+91-22) 2572 3702
Email : adeanrnd@iitb.ac.in
Website : www.iitb.ac.in

IIT Bombay

प्रा. के. कुरीयन आयसॅक
सह संकायाध्यक्ष (अ एवं वि)
Prof. K. Kurien Issac
Associate Dean (R & D)

To whomsoever it may concern

This is to inform that M/s Vision Earthcare Pvt Ltd. is a company, which is being incubated in the Society for Innovation and Entrepreneurship (SINE) at IIT Bombay, towards promotion, marketing, sales, support and services in connection with Soil Biotechnology, developed by Prof.H.S.Shankar, Chemical Engg. Deptt and his students at IIT Bombay.

Two Indian patents have been granted to IIT Bombay in this regard (Patent Nos.203744 on Process for Waste Water Renovation and 203425 on Process for Treatment of Organic Solid Waste both filed on 26 April 2002) and permission has been given to Vision Earthcare Pvt Ltd. to commercialise this technology. Enquiries to Vision Earthcare Pvt. Ltd. related to the use/commercialisation of the technology need not be routed through IIT Bombay.

Also, a US patent 6,890,438 B2 on "Processes for treatment of organic wastes" was granted to IITB on May 10, 2005.

21/02/08

Associate Dean Research and Development
Indian Institute of Technology Bombay

Dated: 21 February 2008

Fig. 13.1: Scan copy of IIT Bombay Letter.

CAMUS-SBT is advanced version of the basic SBT technology which uses less space, is easier to operate and offers superior water quality. Quality of CAMUS-SBT plant performance critically depends on following factors. 1) Process design as per site conditions2) Bio-media selection and qualification, 3) Implementation of Media bed during execution4) Culture and Catalyst for inculcating biology in the media bed. All components for CAMUS-SBT plants are tested in-house under IIT Bombay guidance.

14. Price list & Cost Analysis of Product

Table 14.1: Cost analysis of CAMUS-SBT (1 MLD) comparison with equivalent products. (*Data as per 2010*)

Technology	CAPEX	O&M (per year)	Total*
CAMUS-SBT	Rs. 1.4 Cr	Rs. 0.14 Cr	Rs. 3.4 Cr
Activated Sludge process	Rs. 1.0 Cr	Rs. 0.65 Cr	Rs. 5.8 Cr
MBBR	Rs. 1.4 Cr	Rs. 0.47 Cr	Rs. 5.0 Cr

Note: *Sum of CAPEX and 10 year OPEX with 5% compound interest.

15. List of Dealer Network in India for CAMUS-SBT

Tele: 23019119
Fax : 23019119

E2 Wks (Design) Sub Dte
Directorate of Works
E-in-C's Branch
Integrated HQ of MoD (army)
Kashmir House, Rajaji Marg
New Delhi 110011

81268/Sem-09-10/Des-2

28 Aug 2009

E-in-C's List 'A' & 'B'

FEED BACK : SOIL BIO-TECHNOLOGY WKSP

1. Planning, construction and maintenance of waste water and its disposal is a challenge. To explore more eco friendly methods and to ensure recycle of waste water, a wksp on Soil Bio-Technology (SBT) was held at IIT Bombay on 27Jun 2009. It was conducted by Prof Shankar and was attended by reps from Zones, ADG D&C, CME and others.

2. SBT is a bio-conversion process based on fundamental reactions like respiration, Photosynthesis, mineral weathering by micro & macro organisms to get desired purification. This technology is an oxygen supplying biological engine and can treat domestic as well as industrial waste which can be recycled and applied in following areas:-

(a) Drinking water purification.

(b) Purification of waste water of community or industry.

(c) Storm water purification for ground water recharge.

(d) Organic liquid hosp waste mgt.

3. SBT is an emerging "Green Tech" devp indigenously in our country at IIT Bombay. A site vis of already existing functional plant based on SBT was held during the wksp and no odours or foul smell were observed in the vicinity. Moreover treatment media and culture for SBT can be designed as per end product requirements based on quality of input (sewage). SBT promises good pay back on the life cycle cost basis and land reqmt of such plants is also comparable to conventional treatment plants.

4. Approximate initial cost , operation cost and reqmt of space for Soil-Bioreactors of various capacities as provided by Prof Shankar is as under:-

(a). Cost of Soil-reactor (US patent no. 6890438 B2). (Excluding Civil/Mechanical & Electrical work)

Capacity (MLD)	Approx Cost Ex-Mumbai (RS) Lacs
0.25	40
0.50	65
0.75	80
1.0	95
For every additional 0.25 MLD	Add Rs 15 Lacs

(b). Requirement of Space (Excluding for SBT reactor unit)

Capacity (MLD)	Approx Space Reqds Sq M
0.25	750
0.50	1000˜ 1500
0.75	1500˜2200
1.0	2000˜3000
For every additional 0.25 MLD	Add 500 Sq M

(c) Running cost-operation and maintenance (Excluding Diesel & Power) : Approximately (1-2) % of cost of SBT Plant.

5. SBT based plants are already in use at few places in our country e.g. one such plant at commissioned at domestic airport at Udaipur (Raj) is performing to the satisfaction of user. Names of firms pursuing SBT in defence environment is att at Appx 'A'.

6. In view of foregoing it is recommended that tech may be tried out in waste water treatment/management techniques in our future projects.

(BD Pandey)
Brig
DDGW (Des)
for E-in-C

Copy to :-

E-4 (U)

43285/CMPT/D-2 dt Aug 2009)

Appx 'A'

1. Some firms pursuing SBT in Defence Environment

a	M/S BRILLIANT WASH TECH 19/26, Shiva Krupa, IInd Floor, Near Laxamikantha Nursery, 4th Main, 4th D. Cross, Madiwala Maruthi Nagar, Bangalore-560068
b	MS CH> RAMA RAJU (MES Registered Class: 'A') Door No: 53-38-4, KRM Colony, Vishakhapatnam-530013
c	M/S ECO WATER SOLUTIONS (E-in-C's Branch Approved) B-83, Okhala Industrial Area, Phase-I, New Delhi-110020
d	M/S GODZOWN TECHNO CON(E-in-C's Branch Approved) G-276, Preet Vihar, Delhi-110092
e	M/S GULABCHAND KEWALCHAND PHED(Raj) Contractor Class : "A" 24, Mission Compound, Near Ajmer Pulia, Ajmer Road, Jaipur-302006
f	M/S KUNAL ENVIRO ENGINEERS 46, 1st Floor, Gangadhar, Gokhale Road (N), Mumbai-400028
g	K/S KSC PVT LTD (Railway Contractor Class "A") 972-973, Royal Villa, Flat No, G-2, Gautam Marg, Nirman Nagar, Jaipur-302019.
h	M/S MOHAN LAL GUPTA (Contractors MES Class-'A' A-126, Janta Colony, Jaipur 302020, Rajasthan (India)
j	M/S QEM TECHNOLOGIES (E-in-C's Branch approved) D-1, Kaushambi, Kashyap Marg, Ghaziabad-201001
k	M/S POWAR DYNAMICS (MES Registered Class: 'C') Door No. 46-22-44, Kalyan Estates, Beside Hotel Mantralaya, Rly Station Road, Vishakhapatnam-530016
l	M/S TEESTA SAI INFRASTRUCTURE PVT LTD (DESIGNERS & CONSULTANTS) (E-in-C's Branch Approved) 8/276, Malviya Nagar, Jaipur-302017
m	M/S VANDANA SYSTEMS 96/2 RT, Prakash Nagar Begumpetha Hyderabad- 500016
n	M/S ULTRA DIMENSIONS (MES Contractors Class-"S") 14-1-42, Ground Floor, Pragati's Regent Nowroji Road, Maharani Peta,Vishakhapatnam

2. Designers & Consultants Firm authorised to give quote :
M/S Teesta SAI Infrastructure Pvt Ltd
(E-in-C's Branch Approved)
8/276, Malviya Nagar, Jaipur- 302017

Fig 15.1: List of dealer network

16. Technical Manual

Technical Manual

Sewage Treatment Plant

CAMUS-SBT

16.1 Introduction

A custom designed CAMUS-SBT water rehabilitation facility (it is indeed a misnomer to call it a treatment facility) that is at the cutting edge of ecological engineering innovation unmatched elsewhere and the winner of many awards for best technology as recognized by both private and government bodies, where other treatment technologies strive to satisfy discharge standards.

Working Principle

The basic Soil Biotechnology (SBT) is covered in part by two US patent (Patent no 6890438 B2 dated 5 May 2005 and 7604742B2 dated 20 October 2009) and 2 Indian patents (Patent no 203744 & 203425) all assigned to IIT Bombay, CAMUS-SBT is licensed is an advanced version of the basic SBT technology which uses less space, is easier to operate and offers superior water quality.

CAMUS-SBT process and its technological advancement have been developed by Prof HSShankar during 2007-11. Any Enquiries for CAMUS SBT process or any IP violations can be addressed to hss@iitb.ac.in and hssiitb@gmail.com.

The CAMUS-SBT technology is based on a bio-conversion process where fundamental reactions of nature, namely respiration, photosynthesis and mineral weathering take place in a media housing micro and macro organisms which bring about the desired purification. Our advanced CAMUS-SBT variation combines the oxygen supplying biological SBT engine and special facilities and additives to improve STP performance and ease of operation. CAMUSSBT can treat all types of water — domestic municipal and industrial. CAMUS-SBT is suitable for treating water with salinity less than 2500 mg/L. If salinity is greater than 2500 mg/L then treatment of such waters require additional features. CAMUS-SBT therefore can treat such waters as well.

16.2 Special Features

CAMUS-SBT is very different from other treatment solutions. Some of these special features are listed in this section. Unlike other treatment facilities CAMUS-SBT does not need expensive pretreatment, equalization or the very expensive to operate Aerators or Membrane systems that other options employ often at drastic operating costs to the Client. As a result in most other technologies operation of effluent treatment facilities is limited to special occasions. Unlike conventional treatment plants which need continuous running CAMUS-SBT allows users to operate the plant in intermittent mode, batch mode and continuous mode as the situation arises. Typically CAMUS-SBT plants are easily able to handle shock load of about 50% over or under design load for a few days automatically.

Low Maintenance: **Apart from easily replaceable pumps specified there are no other moving parts in the CAMUS-SBT plant. In case of mechanical failure of pumps all the operators have to do is to replace the broken down unit with a similar unit from the market and restart the process**

High Aesthetics: The CAMUS-SBT plant is generally adorned with specially selected plants to give it a garden like appearance. The garden is not essential but most of our clients and perhaps even you have opted for greenery. There is however a secondary function to the plants: They behave as bio-indicators to the health of the entire process. Toxic waste entering the process will have a detrimental effect to the health of the plants and corrective action can be immediately initiated.

Low Depreciation: Since the plant contains very little mechanical equipment apart from the pumps and the civil works themselves depreciate over larger time scales (~30 years). There are considerable financial benefits to you.

Low Operating Cost: As mentioned earlier since there are no special machines apart from the process pumps. Therefore the operating power requirements are very minimal and operators themselves need minimal training to operate the plant. At its simplest the plant is operated by turning it on when there is adequate water in the influent tank and turning it off as soon as there is enough water in the final storage tank. One person to periodically maintain the top bed to prevent water logging at the top of the bed is required.

Quality Improvement: One unique aspect of CAMUS-SBT is the incremental improvement in output water quality as the bioreactor beds adjust to the specific influent composition from your processes. A 10 year old CAMUS-SBT plant will routinely deliver superior performance than a new plant. All this with little external input from your side.

Low Sludge: Most other technologies require you to ship the sludge generated to a disposal station such as a land fill at significant cost not to mention much hassle. CAMUS-SBT avoids sludge generation and treats all of it within the process itself. However a provision for a bio-fertilizer from the process can be arranged should the customer need such a facility for other landscaping use.

No Odor: Conventional treatment plants create a very bad working environment with many noxious fumes. They therefore have to be sited far away from living and working spaces. CAMUS-SBT is completely odorless and the output water is not conducive to disease causing insects such as mosquitoes and flies.

Superior Water Quality: In most CAMUS-SBT plants treating normal sewage, the output water is exceptional. With proper final polishing with chlorine for disinfection where required it is near drinking water standards. Only cultural inhibitions prohibit drinking and should the customer desire it we offer such solutions also.

16.3 Construction Details of CAMUS-SBT Plant

Civil Construction

- Civil work can be done with Brick/PCC/RCC/Gabion as per the client expertise. Water proofing is compulsory for all the tanks.
- The bioreactor should be open to air and can be made either underground or above the

ground as per client's convenience. Suitable ventilation should be provided. Bioreactor floor needs water proofing.

- The bio-reactor shall be designed to take the load of 4tonnes/sq.m

Media Work

- The construction CAMUS-SBT plant as per guidelines will involve design, media testing, preparing, transporting, providing, laying, culturing and commissioning of bio-media as per patent.
- Primary crushing CAMUS-SBT patented media is needed as per surface are requirement.
- Fill the under drain material first then fine media and large sized particles on top.
- Add the culture and catalyst and do some plantation on the top.

Mechanical & Piping

- Providing the submersible sewage pump for pumping raw sewage water from raw water tank to the bio-reactor.
- Installation of submersible fresh water pumps for recycling the water from treated water tank to the bio-reactor.
- Providing, fabricating, assembling, fixing, testing and commissioning of U-PVC piping network on the top of bio-reactor, pipes suitable for the respective working pressures with all fittings and specials, threaded adopters, flanges, e.g. couplings, tees, bends, reducers etc., jointing as per manufacturers recommendations. All including pressure testing of the installation.
- Providing the bar-screens in the raw water entry chamber.

Electrical

- Providing of non-compartmentalized motor, control panel for various pump drives of 1HP and 1.5 HP ratings suitable for 3PH & N, 415 V AC, 50 Hz electric supply. The control panel will have the provision for two raw water pumps, 1 recycling pump, 2 discharge pumps and 1 small dosing pump for disinfection

- All terminations will be finger touch-proof. The panel shall be completely compartmentalized and complete with relays, contactors, starters, sequence controller Copper Bus Bars, designation labels as per requirement Providing the Level sensors, indicators & alarms. This includes the cabling work from the level sensors in tanks to control panel and complete integration of the system

16.4 Technical Specifications

Table 16.4.1: Typical outlet quality of water (design as per inlet COD concentration of 500mg/l)

SN	Item	Output (limit)
1	pH	6.5-7.5
2	BOD-5day (mg/L)	<10
3	COD (mg/L)	<30
4	TSS (mg/L)	<10
5	E-Coli (CFU/100ml)	< Nil (after chlorination)*
6	Coliform (MPN/100ml)	<100, Nil (after chlorination)*
7	Residual Chlorine (mg/L)	>1
8	DO (mg/L)	>4

*Chlorination not recommended for gardening application
** Quality of influent to be ascertained as per site conditions

Table 16.4.2: Plant operating design conditions for 1MLD plant

Item	Specification
Capacity.	1000 KL/day
Duration of Operation of raw water pump (P1)	16 hours per day
Rate of Sewage Input.	40 KL/hour
Treated Water Tank Capacity	~250 KL
Height of Bioreactor	1.8 M
Pumps	Submersible
Input Water Quality Standard	Customer Specs
Output Water Quality Standard.	As above (Irrigation)*

16.5 Operation

Ease of operation is the key feature of the CAMUS-SBT plant. To assure a very low downtime all components chosen are of very high quality and reliability. The plant is operated from a single control panel. Start the plant by switching on the main power button on the control panel. However to start the bioreactor follow the guidelines.

1) Ensure that there is adequate water in the raw water tank. The system will automatically shut off if the levels of water fall below a minimum safety threshold in the raw water tank. To ensure longer pump life please ensure

that the plant can be run for the prescribed 6 hour duty cycle to prevent excessive starting and stopping of pumps. However the system can be turned off at anytime if the output volumes required are fulfilled.

2) Once the main is turned on, pumps are turned on ensure that the pumps are spraying water on the main bio reactor areas as marked in the process flow diagram. In Automatic mode pumps in the process cycle will only start after sufficient water is available in the respective sumps to start the next step in the process.

3) Water logging in the Bioreactor area is an indication that routine maintenance is required. Please rake the Bioreactor trench areas with a suitable rake and dispose of the top one inch. The harvested layer typically has no odors and can be used for any gardening purposes.

4) Periodically the distribution ports on pipes may be choked with plastic and other detritus and the same should be cleared to ensure smooth distribution.

5) Large pieces sucked into distribution pipes accumulate at the end caps. Periodically open the end caps and run the plant.

16.6 Troubleshooting

CAMUS-SBT plant is designed to handle many exigencies of operation however sometimes there are issues that may need special attention. Please read the above chapter for correct operation of the plant. If all the parameters appear normal and the plant still does not appear to function correct some remedial measures may be necessary.

Vegetation in the Bio-reactor is dying: This indicates problem in raw water entering the process. It means that the constructed ecology in the bioreactor is failing and urgent remedial measures are needed. Analyze raw water for pH and TDS, electrical conductivity. The plant is to be operated after remedial measures are put in place else our patented media will have to be reinstalled. This is a major cost and should not be overlooked. The most common cause of failure is listed below A) Saline water > 8000 ppm salt is entering the process. B) pH of water is very different from neutral, C) Plant is being run at greater than design capacity either in oxygen demand terms OR D) Plant is being run at greater than design capacity in Flow rates OR E) toxins have entered the plant via raw water /sewage.

***Remedial measures*:** CAMUS-SBT Plant must be flushed with potable water until plantation above shows adequate signs of revival. Care must be taken that the operation should be between 30 to 50% of the design flow rate and operated at that level for a maximum of 4 hours

a day for 3-4 days to flush out any toxins in the system. Monitor the water in the treated water tanks for any abnormal color or odor. In general the system should be devoid of odor and color. During this rehabilitation do not reuse the treated water for flushing operations. Monitor the salinity of exit water and stop potable water flushing when levels are below 2500 ppm.

Foul odor in the output water: This indicates that the process is not performing and the oxygen demand is not being met and the process has turned anaerobic instead of the highly aerobic nature that it was designed for. This problem occurs if raw sewage oxygen load is much higher than designed. Generally reducing the flows into the plant for a week should solve the problem or continuously recycling the treated water until the odor disappears.

Residual color in the output water: If there are non-recalcitrant organic dyes in the input water your CAMUS-SBT should be able to remove it completely. However in certain case such dye compounds are not fully removed and generally can be removed by water flushing

Pumps stop working: The standard submersible pumps used should generally have a very long life but if they stop working, find any competent pump repair specialist and have them repaired without disturbing the level control settings on that particular pump.

Heavy caking and water logging on top layer: Follow top layer raking as mentioned in the operations in chapter 6. If water logging is still evident then replace the entire 6 inchesof top materials with additive.

Cold weather: In very cold subzero ambient weather some CAMUS-SBT plants tend to choke up due to solidification of fats in distribution lines or via ice formation. In case such climatic conditions are common in your geography then it is advised to ensure that the water temperature exceeds 15 C. For subzero temperature greenhouse infrastructure is to be created so that temperature inside CAMUS-SBT is in the range 20- 30C.

16.7 Warranty

The CAMUS-SBT plant is composed of 4 components each with different life cycles.

1. Civil: An expected lifetime of 30 years however technology provider cannot guarantee civil works.

2. Mechanical: Pipes and fittings are warranted for normal wear and tear and must be periodically replaced if they fail. This is also the function of the care taken by maintenance staff hired to look after the plant. If they routinely step on the pipes then they may crack and have to be replaced.

3. Electrical: The control panel is warranted for 1 year

4. Bio-reactor: Is warranted for 10 years under normal working conditions along with annual maintenance contracts. Saline poisoning or toxic poisoning, low pH poisoning of the bioreactor is not covered under this warranty. The user is cautioned to not load the system with acidic, industrial toxins and saline input water.

17. Clearance from Ministry of Environment and Forest, Govt. of India

2.6.2.5 Soil Biotechnology (SBT)

Soil Biotechnology (SBT) process for organic waste (solid and liquid) processing developed at Chemical Engineering Department IIT Bombay has the necessary features of green technology that are cost effective, energy efficient and is available to the users at the scales required. The intellectual property rights of the technology are covered under Indian and US Patent.

The science, technology and performance features of SBT are outlined below.

Process Description & Design :

A typical SBT plant consists of impermeable floor (PCC or HDPE membrane depending upon the terrain) & containment with suitable water proofing (UCR/RCC walls), raw water tank, filtered water tanks, bioreactor containing suitable media, culture and bio indicator plants required for the wastewater renovation.

The bioreactor is constructed over the impervious floor. It consists of soil bays containing media, which is cultured and planted with select bio-indicators. Plant operation is set to achieve the required level of purification. Plant operation involves pumping the raw water into the soil bays, sprinkling specified additives and maintaining the bio-indicators and all functions s prescribed and demonstrated during training. The renovated water is to be pumped via suitable distribution system for gardening.

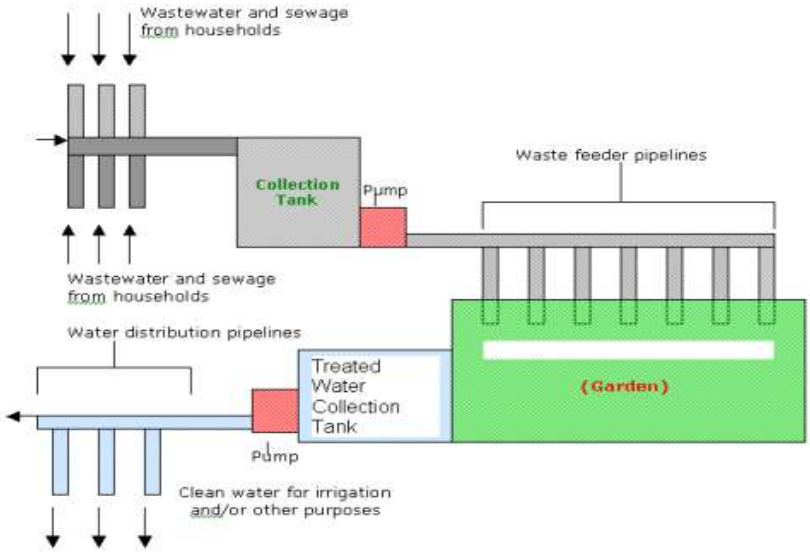


Figure 2.4 Flow Diagram for Liquid Waste (Sewage/Effluent) treatment by SBT

Fig 19.1: Scan of MOEF document for SBT
(http://enfor.nic.in/divisions/iass/Construction Manual.pdf)

18. Raw Material Details

Raw material details are available in patent document USPTO (Patent no 6890438 B2 dated 5 May 2005 and 7604742B2 dated 20 October 2009). CAMUS-SBT media materials testing and qualification can be done by CAMUS-SBT manufactures.

19. Photographs of CAMUS-SBT Plant

Fig 19.1: 3000 KLD SBT plant in BMC Worli, Mumbai.

Fig 19.2: 30 KLD SBT plant in Godrej, Pondicherry.

Fig 19.3: 40 KLD CAMUS-SBT plant, Mumbai Railway Vikas Corporation (MRVC)Virar.

Fig 19.4: 30 KLD CAMUS-SBT plant in Visaka Nagpur.

Fig 19.5: 160 KLD CAMUS-SBT plant in AAI plantLucknow.

The Ministry of External Affairs selected SBT as one of the India's innovative technologies. The video is attached as a soft copy in the form of CD or it available in web link (http://www.youtube.com/watch?v=dKWVtZ81mY0).

Soil bio technology plant operation video in ACCEPT society (web link: http://www.youtube.com/watch?v=p4vU5XluqOw)

LINKS TO ATTACHMENTS OF THE DOCUMENT

- Technical instructions manual TI NO. 06/2011 by MES, Ministry of Defense IHQ (Army) (http://www.mes.gov.in/imgtis/TI%2006%20of%202011%20Sewage%20Treatment%20Plant.pdf)
- Review about SBT from Ministry of Environmental Forestry (MOEF) (http://envfor.nic.in/divisions/iass/Construction_Manual.pdf)

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