In-Situ Remediation of Estero de Paco by the Application of Local Organo Minerals

Merlinda A. Palencia,
ASEAN Ch.E., Ph.D.

OUTLINE

I. Introduction

II. Methodology

III. Results and Findings

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Robust Industrial/Commercial Activities

Application of local Organo Minerals as a viable bioremediaton technique ... Leads to an economic remediation of estuaries, lakes and river

OBJECTIVES

1. Determine the physical and chemical properties of estero water before and after remediation in terms of : TSS, Temperature, Odor, pH, DO. BOD, and COD;

2. Evaluate the effect of the concentration, treatment time, and application method on the physical and chemical properties of water;

Specific Objectives

3. **Identify three critical remediation points where the application of organo minerals will have significant contribution to the overall water quality improvement;**

4. **Determine the effective concentration and application method during wet and dry seasons, and at critical organic load condition;**

Specific Objectives

5. **Compare the effect of the application of the organo minerals with other commercially available remediation enzymes.**

II. METHODOLOGY

A. Water Sampling

- 6 Sampling Sites
- Aggregate Sample from three sampling points,
  1.5-2.0 m apart
- Samples collected at 1.0 ft below surface

- **Organo Minerals Application at 0.5 - 1.5 kg/m^3**
- **Sequential powder dispersion & tea bag methods**
- **Floatation system used to make tea bags remain at 1.0 ft below water surface, stationary at specific points**

Water Characteristics

Physical & Chemical Properties :

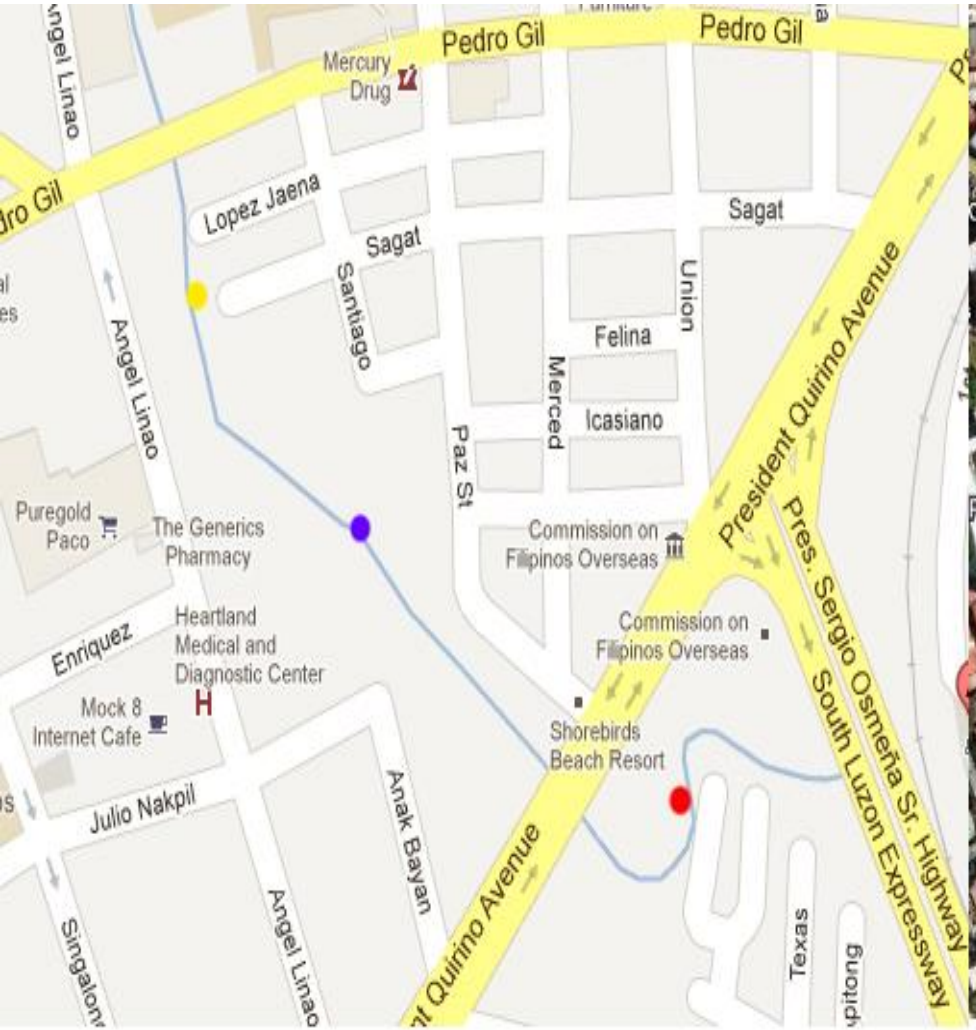
Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF 21st Edition.

III. RESULTS

&

FINDINGS

LOCATION OF SAMPLING SITES 1, 2, & 3:



Map View

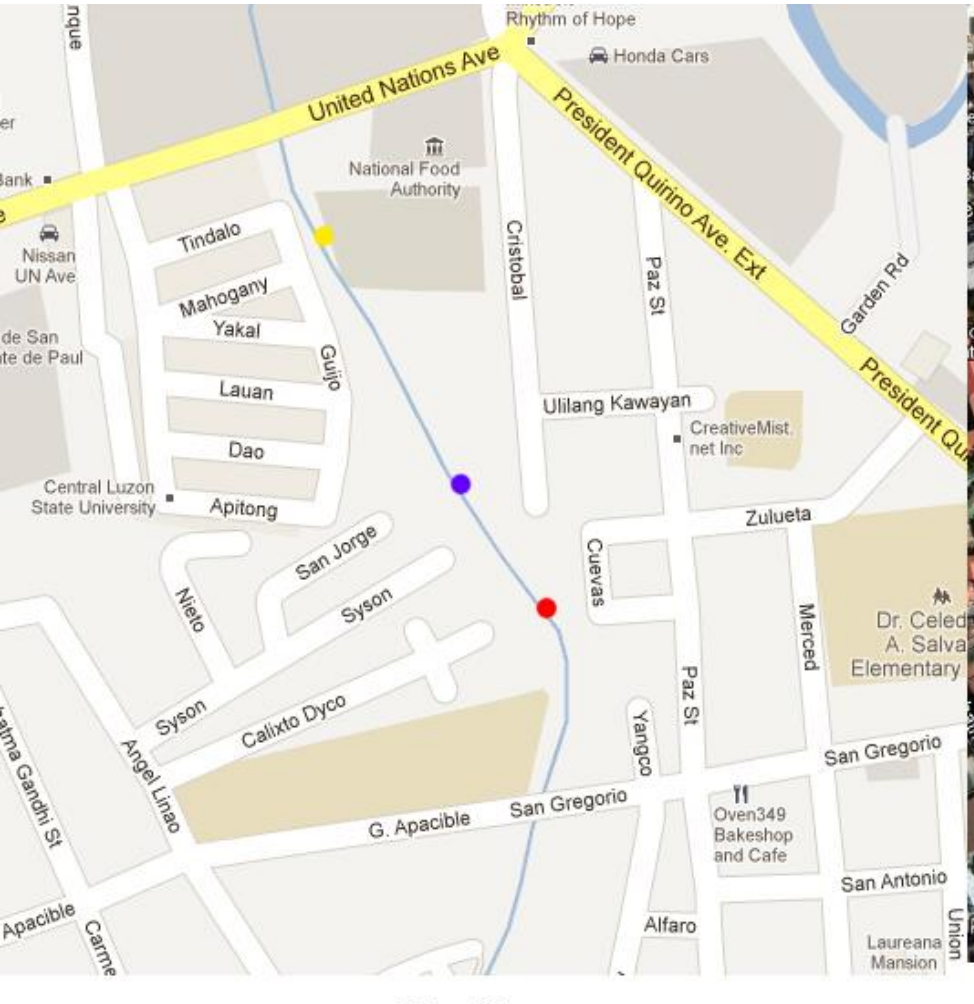
Satelite View

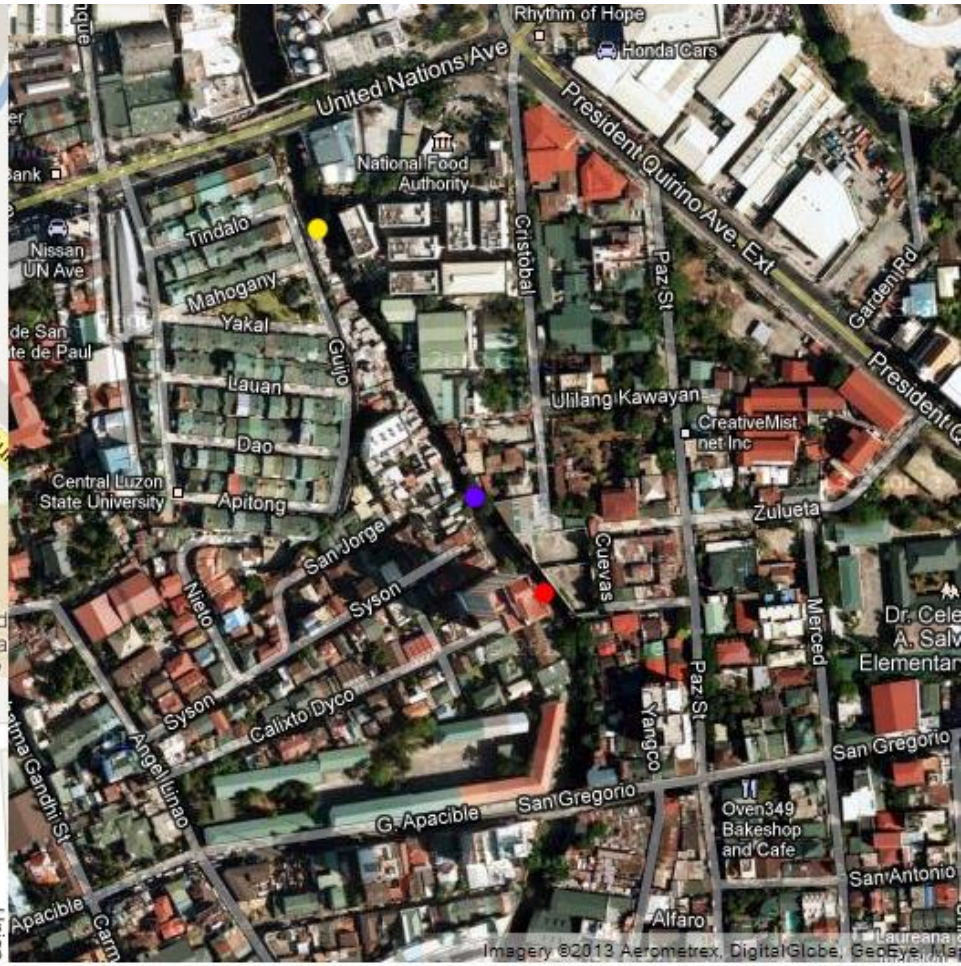
Site 1 Latitude - 14.57556 Longitude - 120.99663

Site 2 Latitude - 14.57681 Longitude - 120.99477

Site 3 Latitude - 14.57775 Longitude - 120.99387

LOCATION OF SAMPLING SITES 4, 5, & 6





Map View

Satelite View

Site 4 Latitude - 14.58211 Longitude - 120.99421

Site 5 Latitude - 14.58291 Longitude - 120.99361

Site 6 Latitude - 14.58445 Longitude - 120.99272


AdU - PCIEERD
Project
Sampling Site 6


AdU - PCIEERD
Project
Sampling Site 4
AdU - PCIEERD
Project
Sampling Site 3


Project
Sampling Site 1

Water Sampling

Characterization of Estero Water Before Remediation

pH Value

SITE	Dry Season	Wet Season
S1	7.1	7.0
S2	7.1	6.9
S3	7.1	7.0
S4	7.2	6.9
S5	7.1	7.0
S6	7.0	6.8

Total Suspended Solids (mg/L)

	DRY SEASON			WET SEASON		
SITE	Low	High	AVE.	Low	High	AVE.
S1	39	800	224	35	46	41
S2	52	448	185	23	118	74
S3	28	128	70	27	138	77
S4	16	58	43	22	120	58
S5	16	104	49	27	173	76
S6	21	120	51	30	64	45

Dissolved Oxygen (mg/L)

	DRY SEASON			WET SEASON		
SITE	Low	High	AVE.	Low	High	AVE.
S1	0	0.7	0.1	0	0.7	0.4
S2	0	0	0.0	0	1.0	0.6
S3	0	0.2	0.0	0	0.7	0.4
S4	0	0.7	0.1	0	0.8	0.5
S5	0	0.6	0.2	0.7	0.9	0.8
S6	0	0	0.0	0	0.9	0.6

Biochemical Oxygen Demand (mg/L)

	DRY SEASON			WET SEASON		
SITE	Low	High	AVE.	Low	High	AVE.
S1	46	335	144	37	147	104
S2	108	269	169	59	233	142
S3	87	178	139	62	146	109
S4	57	114	97	56	198	123
S5	44	141	93	72	107	85
S6	55	331	137	83	155	107

Chemical Oxygen Demand (mg/L)

	DRY SEASON			WET SEASON		
SITE	Low	High	AVE.	Low	High	AVE.
S1	78	462	220	89	179	135
S2	160	398	263	129	255	211
S3	160	278	212	129	159	148
S4	120	198	155	129	466	238
S5	80	258	150	137	190	155
S6	120	586	243	119	164	144

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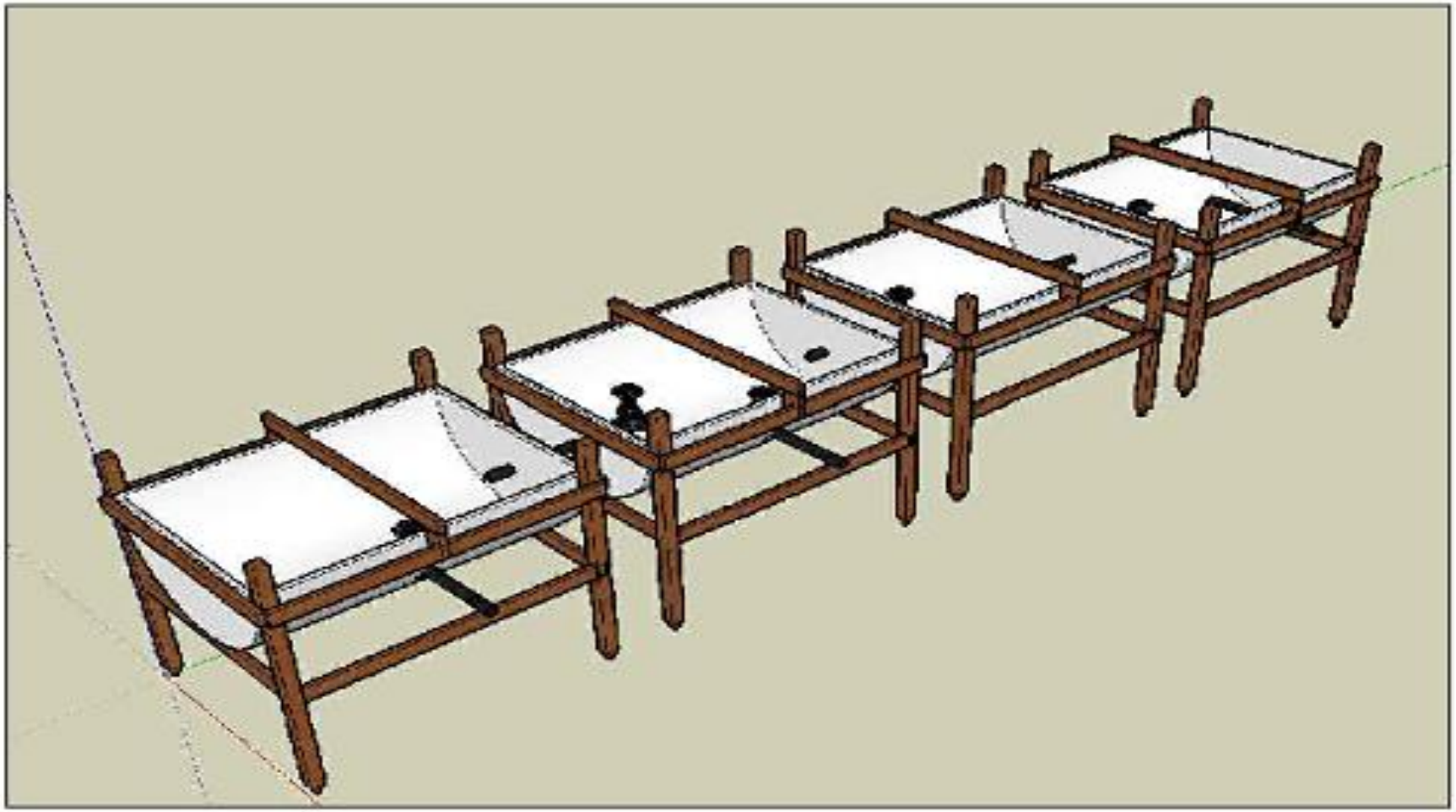
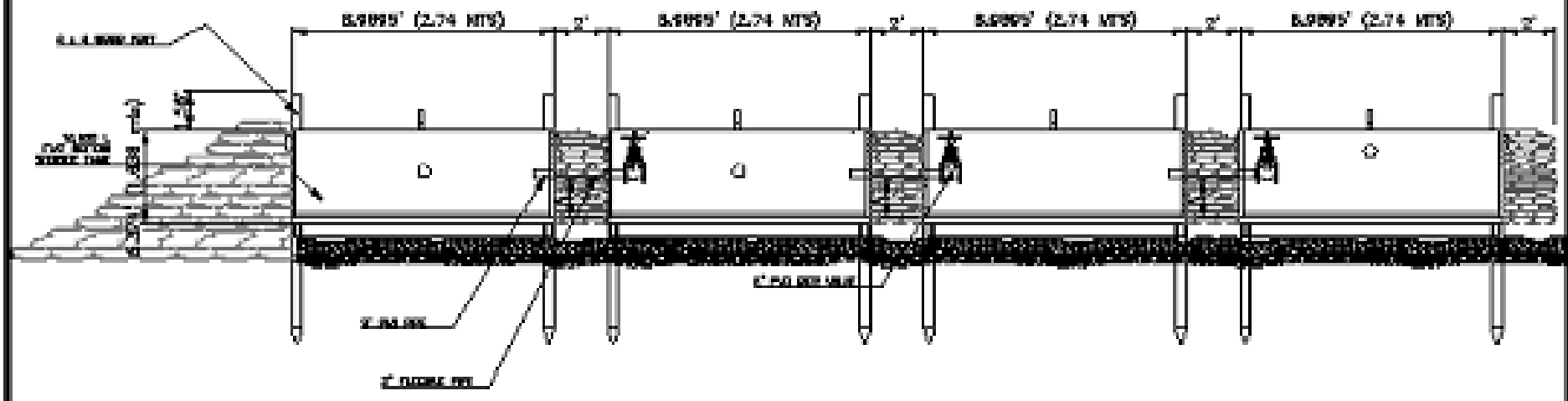
Remediation Chamber Construction Plans

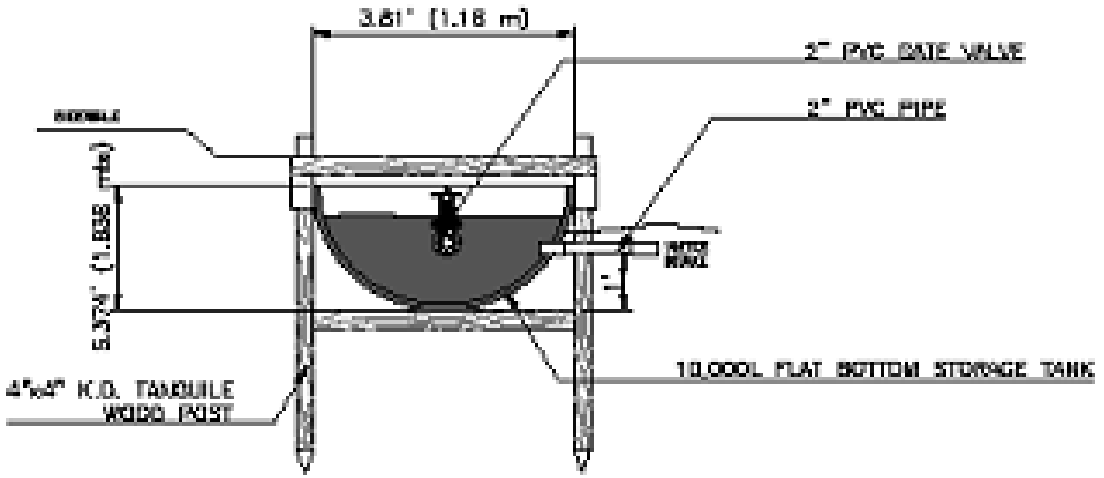


PERSPECTIVE

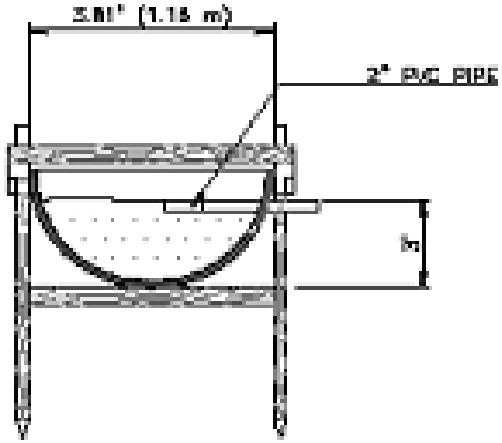
RESEARCH PROGRAM LEADER : Dr. Merlinda A. Palencia | CHAMBER for IN-SITU REMEDIATION OF ESTERO DE PACO



1 SECTION - A
SCALE : 1/8 FEET



2 SECTION - B
SCALE : 1/8 FEET



3 SECTION - C
SCALE : 1/8 FEET

RESEARCH PROGRAM LEADER : Dr. Nerlinda A. Polencia

CHAMBER for IN-SITU REMEDIATION OF ESTERO DE PACO

Remediation in Chambers

- **pH Value**

	D0	D2	D4	% Change	Conc.
• Mean	7.3	8.2	8.4	15.2	@ 1.5 g/L
• Mean	7.1	7.2	7.6	6.7	@ 1.0 g/L
• Mean	7.7	7.8	8.9	15.6	@ 0.5 g/L

- **1.0 g/L posted lowest Change in pH value**

Remediation in Chambers

- **Total Suspended Solids**

	D0	D2	D4	% Change	Conc.
• Mean	48.5	41.75	37.75	-22.2	@ 1.5 g/L
• Mean	24.5	29	12	-51.0	@ 1.0 g/L
• Mean	88	49.8	34.8	-60.5	@ 0.5 g/L

- 0.5 g/L posted highest reduction in TSS

Remediation in Chambers

- **Dissolved Oxygen**

	D0	D2	D4	% Change	Conc.
• Mean	2.1	2.8	3.4	63.4	@ 1.5 g/L
• Mean	1.9	2.9	4.2	117.4	@ 1.0 g/L
• Mean	1.4	0.9	5.7	268.3	@ 0.5 g/L

- 0.5 g/L posted significant DO Increase

Remediation in Chambers

- **Volatile Organic Compounds**

	D0	D2	D4	% Change	Conc.
• Mean	0.13	0.06	0.06	-53.7	@ 1.5 g/L
• Mean	2.33	0.12	0.16	-93.1	@ 1.0 g/L
• Mean	0.203	0.13	----	-34.6	@ 0.5 g/L

- 1.0 g/L posted significant VOC Reduction

Remediation in Chambers

- **Biochemical Oxygen Demand**

	D0	D2	D4	% Change	Conc.
• Mean	212.5	63.75	36.5	-82.8	@ 1.5 g/L
• Mean	78.3	47.0	26.5	-66.1	@ 1.0 g/L
• Mean	62	56.3	26.5	-57.3	@ 0.5 g/L

- 1.5 g/L posted significant BOD_5 Reduction

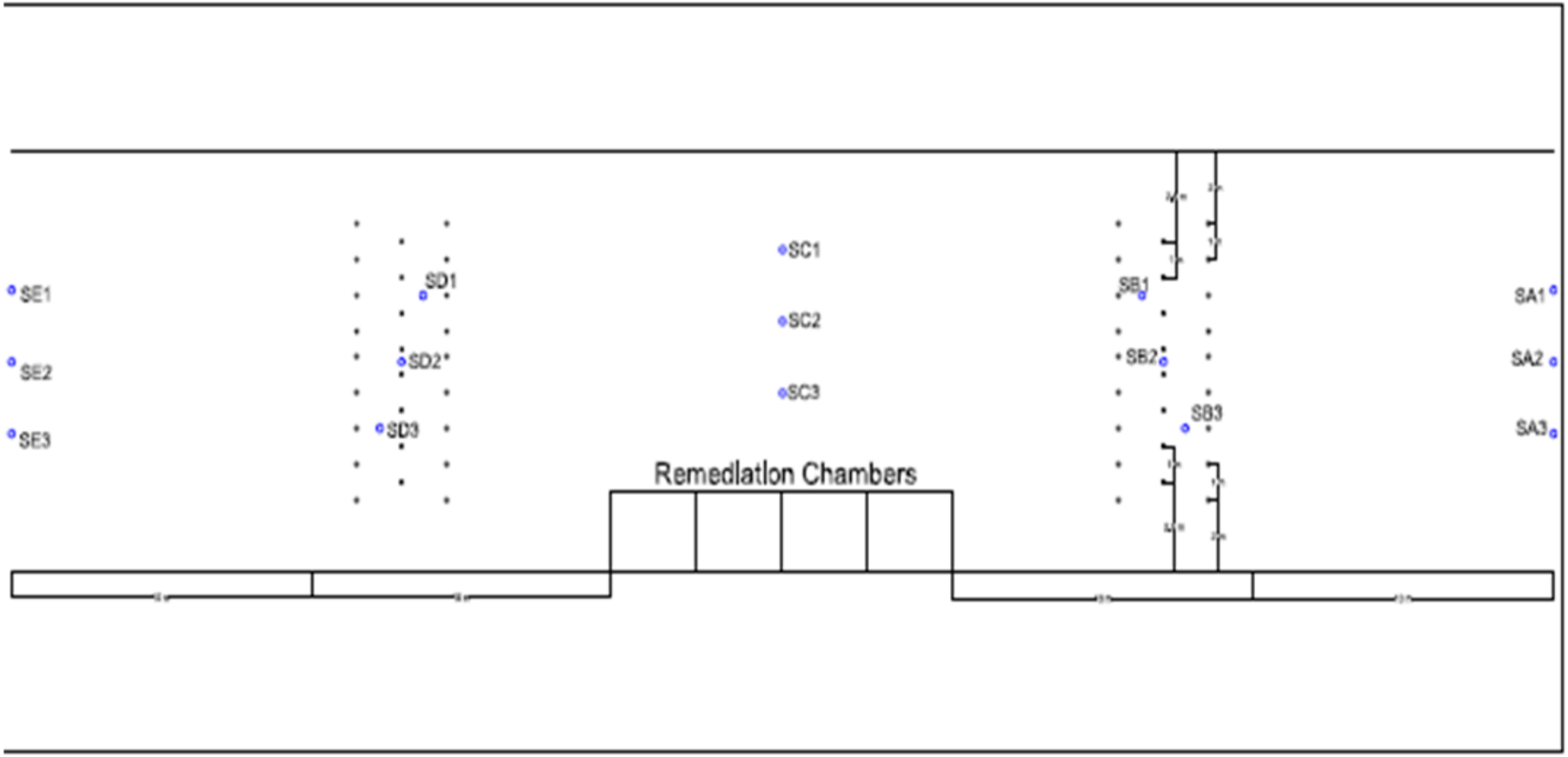
Remediation in Chambers

- **Chemical Oxygen Demand**

	D0	D2	D4	% Change	Conc.
• Mean	230	152	92.8	-59.7	@ 1.5 g/L
• Mean	75.8	66.5	39.8	-47.5	@ 1.0 g/L
• Mean	189	154.8	106.0	-43.9	@ 0.5 g/L

- **1.5 g/L posted significant COD Reduction**

SITE DEVELOPMENT PLAN FOR CONTROLLED REMEDIATION AREA



NET Installation @ Remediation Controlled Area

TEA BAG PLACED IN COOPS

IN SITU REMEDIATION

BOD	Day 0	Day 7	Day 14	% Change
A	297	123	108	-63.6
B	419	150	114	-72.8

COD	Day 0	Day 7	Day 14	% Change
A	362	195	195	-46.1
B	617	214	195	-68.4

IN SITU REMEDIATION

TSS	Day 0	Day 7	Day 14	% Change
A	198	68	58	-70.7
B	277	64	76	-72.6

VOC	Day 0	Day 7	Day 14	% Change
A	0.47	0.335	0.065	-86.2
B	0.385	0.1825	0.115	-70.1


Remediation Area After D4

ORGANO VS. COMMECIAL ENZYME

BOD	Day 0	Day 10	Day 14	% Change
Organo	191	26	36	-81.2
Enzyme	191	210	625	227.2

COD	Day 0	Day 10	Day 14	% Change
Organo	219	39	50	-77.2
Enzyme	219	388	1590	626.0

ORGANO VS. COMMECIAL ENZYME

TSS	Day 0	Day 10	Day 14	% Change
Organo	52	4	11	-78.8
Enzyme	52	100	400	669.2

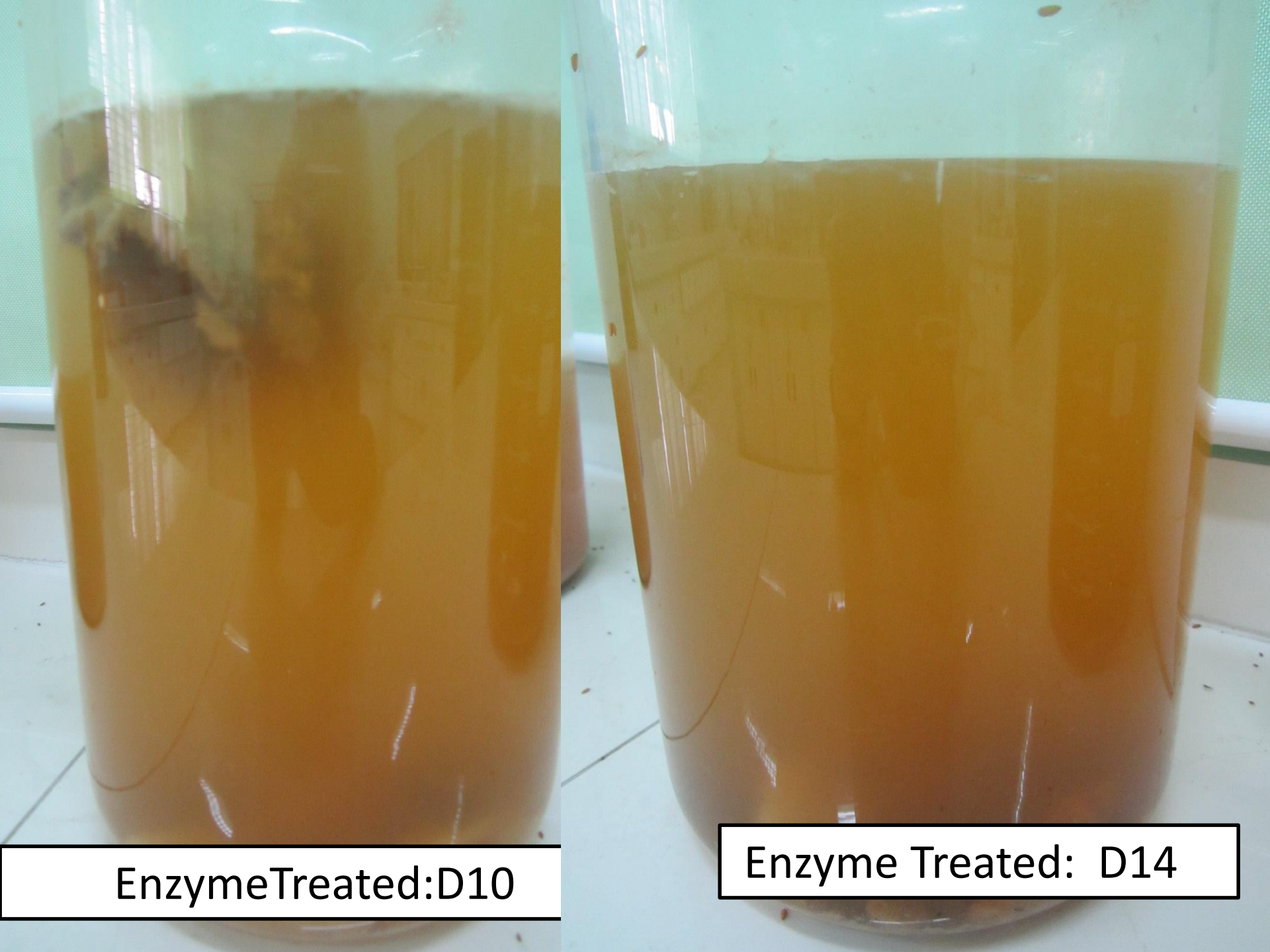
VOC	Day 0	Day 10	Day 14	% Change
Organo	1.65	0.31	1.005	-39.1
Enzyme	1.65	1.415	2.32	40.6

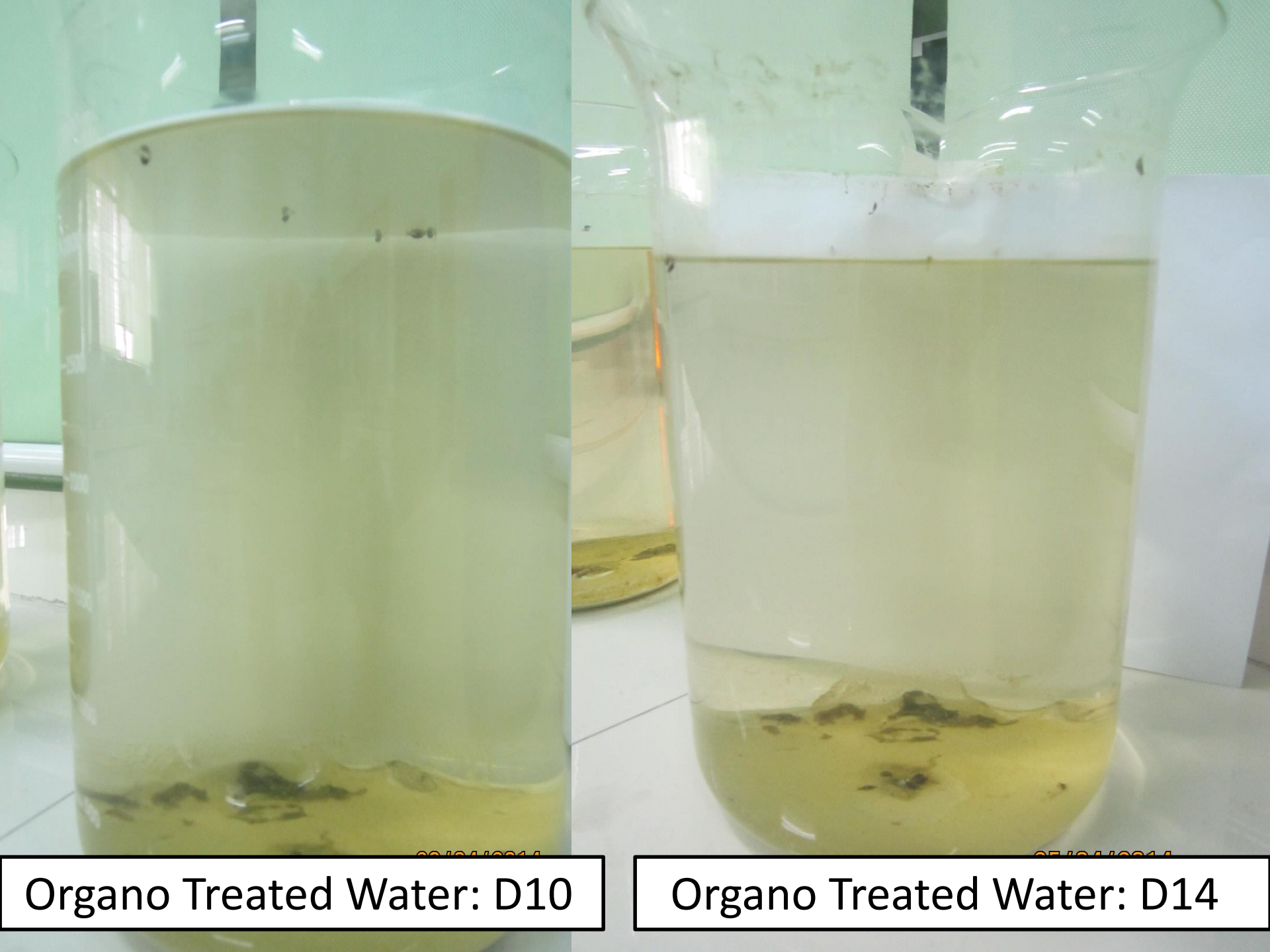
ORGANO VS. COMMECIAL ENZYME

DO	Day 0	Day 10	Day 14
Organo	0	4.8	5
Enzyme	0	0	0

WWater Sample: Organo

W Water with Enzyme : DO


EnzymeTreated:D10
Enzyme Treated: D14



Organo Treated Water: D10

Organo Treated Water: D14

CONCLUSION

CHAMBER REMEDIATION

1. **TSS Reduction:**
   22- 60% (5 g/L)

2. **Odor/VOC Reduction:**
   35 -93% (1.0 g/L)

3. **DO Increase:**
   1.4 – 5.7 mg/L (1.0 g/L)

CONCLUSION

CHAMBER REMEDIATION

1. **BOD Reduction :**
   57 - 83% (1.5 g/L)

2. **COD Reduction:**
   44 - 60% (1.5 g/L)

IN SITU REMEDIATION : @1.0 g/L (D14)

1. **TSS Reduction:**
   71- 73%

2. **Odor/VOC Reduction:**
   70 - 86%

3. **DO Increase:**
   0 – 5 mg/L

IN SITU REMEDIATION : @1.0 g/L (D14)

1. **BOD Reduction :**
   64 - 73%

2. **COD Reduction:**
   46 - 68%

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