कयर बोर्ड
(सूक्ष्म, लघु और मध्यम उद्यम मंत्रालय, भारत सरकार)
COIR BOARD
MINISTRY OF MSME, GOVT. OF INDIA
AN ISO 9001: 2008 CERTIFIED ORGANIZATION

Development of Research and Training centre for Tannery Waste treatment using coir pith and Effective microorganisms to convert it into organic manure

Project Final Report

Submitted to

Central Coir Research Institute

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Aim

Tannery is a place where animal hides are tanned and the workshop of tanners. Tanning is the process of treating skins and hides of animals to produce leather which is more durable and less susceptible to decomposition. Tannery wastes are mainly characterized by high salinity, high organic loading and specific pollutants such as chromium. Nearly, 60,000 L of liquid and 1 ton of solid wastes are released from single tannery industry per day and thus polluting the environment around the industries. At present, coir pith (by-product of coir yarn industry) is being available in and around Tamil Nadu and Kerala. Hence, the aim of this project is to develop a Research and Training centre for the treatment of tannery waste using coir pith and Effective microorganisms to convert it into organic manure at Bharathidasan University.

Objectives

- **Treatment of Tannery waste, coir pith and Nava Rasa Karaisal (NRK-Effective microorganisms) and conversion into organic manure**
- **Application on field**
- **To develop the Research centre at Bharathidasan University.**

Effective Microorganisms

NRK (Nava Rasa Karaisal) is an organic product and it has microbial consortia. Microbes play an essential role in the biodegradation process such as Bacteria, Fungi, *Actinomycetes* and Yeast. The ingredient present in NRK enhances the microbial population which favours the degradation of tannery wastes along with coir pith and it is also possible to convert them into organic manure.

More number of tannery industries is present near Bharathidasan University and release large amount of solid and liquid wastes which pollutes the surrounding environment. During treatment of these wastes using microbial consortia, it is possible to reduce chemical contaminant including heavy metals present in tannery waste. The treated liquid form can be utilised for foliar and irrigation purposes and the solid can be used as basal fertilizer.

Work Plan

I Year

- **Collection of tannery effluent and coir pith from industries.**
- **Analysis of Physicochemical parameters (Initial).**
- **Treatment of Tannery (solid & liquid) wastes with coir pith and Nava Rasa Karaisal (NRK-Effective microorganisms)**
- **Test the above effluent on seeds (seed germination)**
- **Microbial analysis**
- **Analysis of Physicochemical parameters and nutrients (Final).**
- **Application on plants**
- **Analysis of growth and yield**
- **Soil analysis**
- **Development of Research centre at Bharathidasan University**

Methodology

A. Analysis of (initial) Physicochemical parameters and nutrients (NPK)

(pH, Temp, EC, TDS, Salinity etc.)

⇩

B. Treatments

1. Tannery (liquid) control 2. Tannery (liquid) + coir pith 3. Tannery (liquid) + NRK 4. Tannery (liquid) + coir pith + NRK

⇩

C. Analysis of (Final) Physicochemical parameters and nutrients (NRK)

(pH, Temp, EC, TDS, Salinity etc.)

⇩

D. Scaling up technology

⇩

E. Application on Field (Paddy & Banana)

⇩

F. Microbial analysis on soil

⇩

G. Analysis of growth and yield

⇩

H. Development of Research & Training centre

A) Collection of Sample

Tannery effluent sample **(Plate - 1)** was collected from a tannery industry Sempattu, near Bharathidasan University, Tiruchirappalli-24, Tamilnadu, India.

PLATE – 1 Tannery industrial wastes

The Coirpith **(Plate - 2)** was collected from coir industries near Srirangam, Tiruchirappalli-6, Tamil Nadu, India.

PLATE - 2 COIR PITH

B) Preparation and Incubation of NRK

Nava Rasa Karaisal (NRK) was prepared by mixing of five cow based products and other four ingredients. It was kept for 2 days of fermentation **(Plate - 3)**.

PLATE – 3 NAVA RASA KARAISAL

Composition of NRK (100 Ltr)

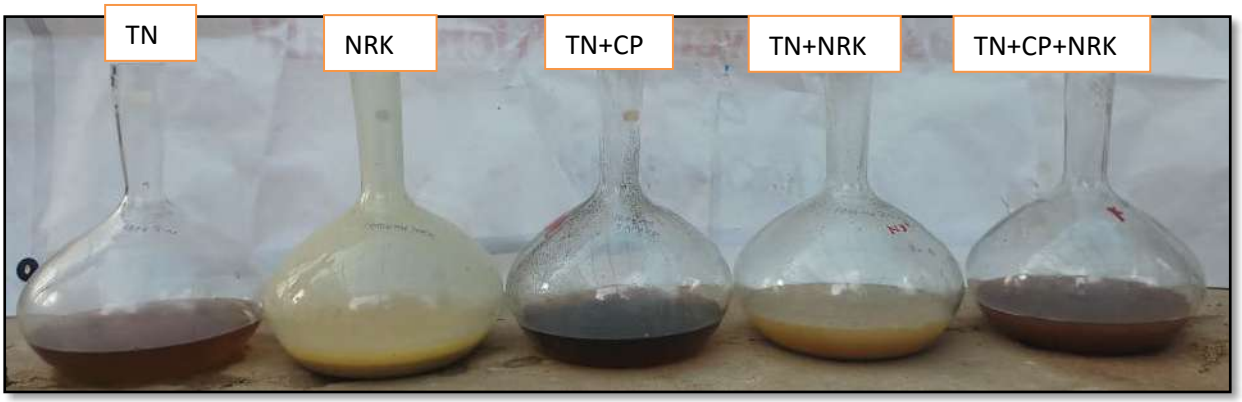
COMPOSITION	CONTENT
Cow dung	10 kg
Cow urine	1 L
Milk	2 ltrs
Besan flour	2 kg
Curd	2 ltr
Jaggery	2 kg
Ghee	100 gm
Banana	12 pcs
Yeast/ Soil	100gms

C) Treatments

i. Foliar

Different treatments were carried out such as 900ml (TN) +100ml (NRK), 900ml (TN)+20g (CP) and 900ml (TN)+20g (CP)+100ml (NRK) in Haffkin flasks and kept for 4 days. After treatment the filtrate (Supernatant) was collected and analysed Physicochemical, Microbiological, Pot & Field study were carried out **(Plate - 4).**

PLATE - 4 Filtrate of treated tannery effluent as Foliar (4th day)



Around 10L filtrate was collected by filtration method **(Plate - 5)**.

Plate - 5 Effect of Coir pith and NRK in tannery effluent

TN: Tannery, CP: Coir pith, NRK: Nava Rasa Karaisal

ii. Basal

Different treatments were carried out such as 5L (TN) + 500ml (NRK), 5(TN) + 5Kg (CP) and 5L (TN) +5Kg (CP) + 500ml (NRK) in plastic containers and kept for 30 days. After treatment the pellet was collected and analysed Physicochemical, Microbiological, Pot & Field study were carried out **(Plate -6)**.

PLATE - 6 Treated tannery effluent as Basal (30th day)

TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

Experiment - I

Analysis of Physico-chemical Parameters

D) Comparison of physicochemical parameters in all treatments

The Physicochemical parameters were analysed for untreated and treated tannery effluent in pellet (Basal) on 30th day and supernatant (Foliar) on 4th day. The parameters were compared in all treatments **(Table - 1).** All the parameters are slightly change in different treatments and the heavy metals are dispersed in combined treatments due to the presence of coir pith and NRK.

Table – 1 Physicochemical parameter analysis of untreated and treated tannery effluent (Basal & Foliar)

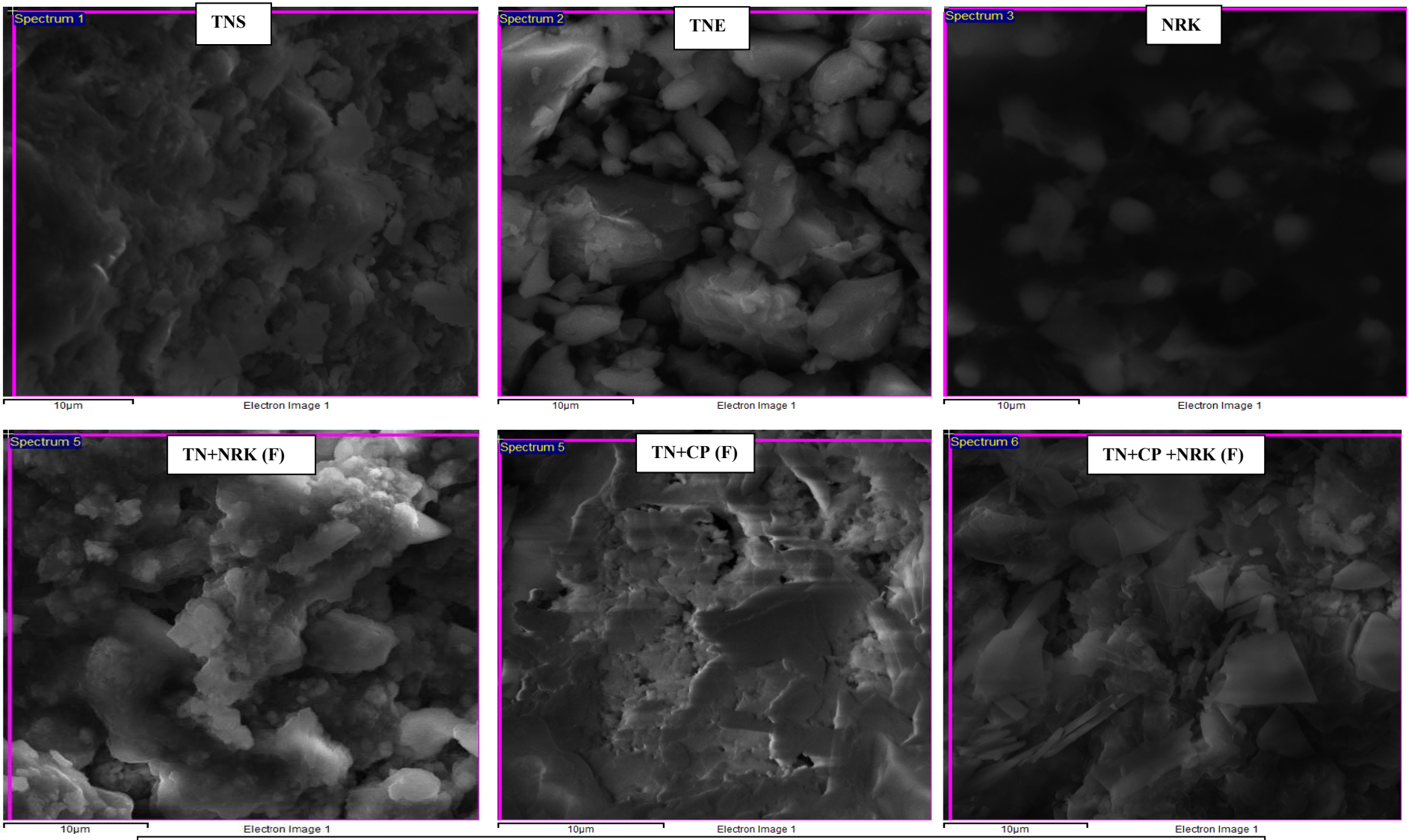
S.No	Parameters	TN (mg/L)	NRK (mg/L)	TN+CP		TN+NRK	TN+CP+NRK	
				Basal mg/Kg	Foliar (mg/L)	Foliar (mg/L)	Basal mg/Kg	Foliar (mg/L)
1	Colour	Dark Brown	Hazen	Dark Brown	Dark Brown	Light Brown	Dark Brown	Light brown
2	Turbidity	<20	<20	-	<40	<20	-	<40
3	pH	8.87	5.64	6.64	6.45	8.87	6.73	6.38
4	EC (mS/cm)	9.88	1.574	0.675	8.438	7.895	0.696	9.45
5	TDS	44.6 (g/L)	9.16 (g/L)	7.65	49.6	37.6 (g/L)	5.65	22.9
6	Total solids	760	834	-	810	710	-	673
7	TSS (mg/lit)	88.9	148.26	-	140.5	74.5	-	120
8	Residual free chlorine	3.46 (g/L)	3.67 (g/L)	-	3.82 (g/L)	2.98 (g/L)	-	3.98 (g/L)
9	Alkalinity	10.5 (g/L)	2.87(g/L)	-	14.5	8.89 (g/L)	-	12.5
10	Total hardness	19.29 (g/L)	4.68(g/L)	-	22.44	16.7(g/L)	-	20.12 (g/L)
11	Salinity	14.4	-	0.687	14.26	-	0.695	13.4
12	Oil and grease	5.53	5.94	-	9.20	-	-	8.13
13	Sulphide	7.82	12.4	-	7.44	7.24	-	5.16
14	Chloride	7.86(g/L)	4.26(g/L)	-	9.12	7.12(g/L)	-	8.9 (g/L)
15	Nitrate	240	172	-	275	234	-	284

16	Nitrite	12.8	10.5	-	16.7	10.8	-	12.4
17	Nitrogen	18.84	12.56	12.5	15.12	15.42	13.7	13.22
18	Phosphorus	290	320	620	306	255	700	294
19	Potassium	2.25	1.86	2.34	3.50	2.20	2.56	3.70
20	Phenolic compound	2.82	3.82	-	2.95	2.50	-	3.50
21	Sodium	3.80	1.60	0.08	2.48	3.64	0.09	2.67
22	BOD	356	545	-	512	276	-	508
23	COD	1.98(g/L)	2.89(g/L)	-	2.78 (g/L)	1.54(g/L)	-	2.61 (g/L)
25	Magnesium	-	-	0.53	1.68	-	0.86	1.28
26	Calcium	-	-	0.34	3.3	-	0.83	-
27	Cadmium	10.0	6.45	-	4.60	8.65	-	4.12
28	Copper	25.0	16.70	1.10	6.42	23.5	1.0	7.88
29	Lead	10.3	8.5	-	3.78	9.7	-	3.76
30	Mercury	1.2	1.3	0.3	1.52	1.10	0.30	1.15
31	Zinc	12.4	16.85	1.86	18.74	11.0	2.25	14.90
32	Chromium	84.6	24.62	2.2	40.00	62.4	2.0	38.65
33	Iron	20.5	36.84	-	30.86	18.2	-	26.80
34	Nickel	6.7	6.25	-	4.40	6.0	-	4.14
35	Selenium	5.5	2.5	0.4	2.32	5.2	0.40	2.30
36	Manganese	5.6	3.0	-	3.45	5.2	-	3.48
37	Fluoride	12.0	10.64	2.45	12.43	8.8	2.4	11.15
38	Arsenic	2.8	3.0	-	1.80	-	-	-

E) Analysis of Scanning Electron Microscopy (SEM)

The surface changes was observed by Scanning Electron Microscopic view in untreated and treated tannery effluent with coir pith and NRK on 4th day (supernatant) **(Plate - 7).**

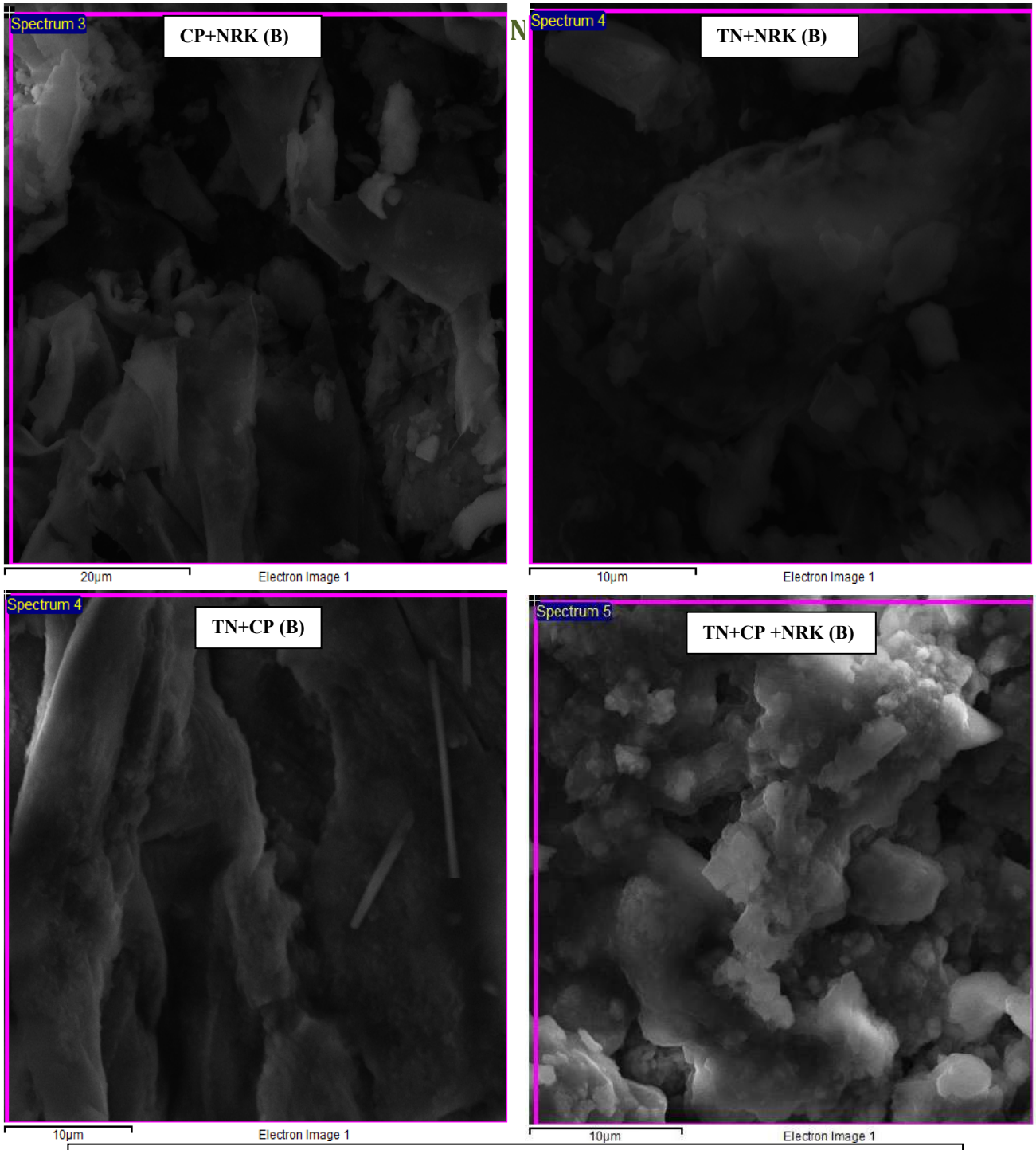
Plate - 7 **Scanning Electron Microscopic (SEM) view of untreated and treated tannery effluent using coir pith and NRK on 4th day (Foliar)**



TNS-Tannery Industry Soil, TNE-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal, F- Foliar

The SEM analysis of combined treated tannery effluent on 30th day was observed (pellet) **(Plate - 8)**. In combined treatment tannery effluent particles and coir pith exhibited the smoothen surface due to the action of microorganisms present in NRK.

Plate - 8 Scanning Electron Microscopic (SEM) view of treated tannery

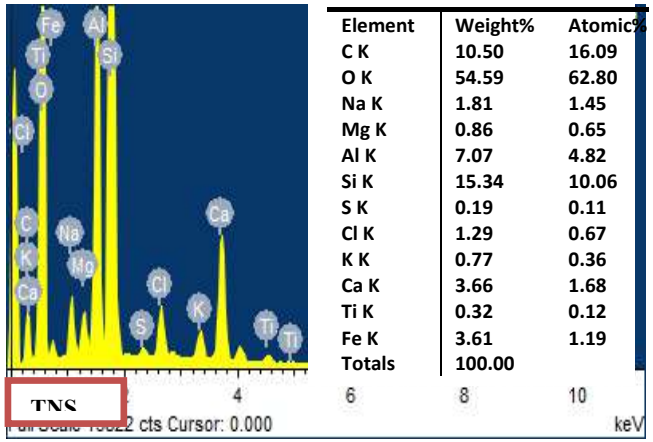


TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal, B- Basal

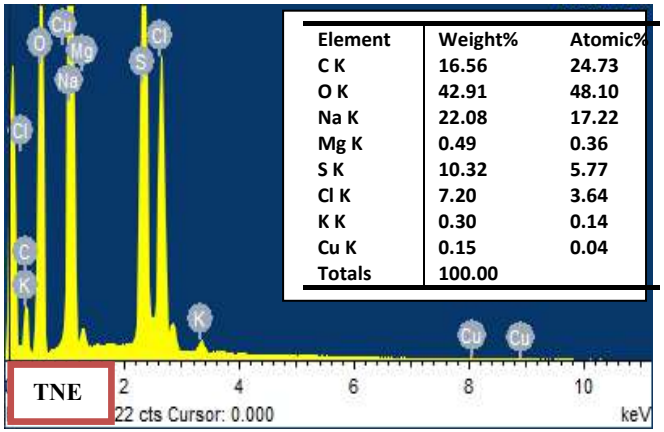
F) Analysis of Energy Dispersive Spectroscopy (EDS)

The EDS analysis of untreated and treated tannery effluent using coir pith and NRK on 4th day (Supernatant) was observed **(Plate - 9).** It was showed the reduction of chemical compounds in combined treatment when compared with all other treatments due to addition of coir pith and NRK.

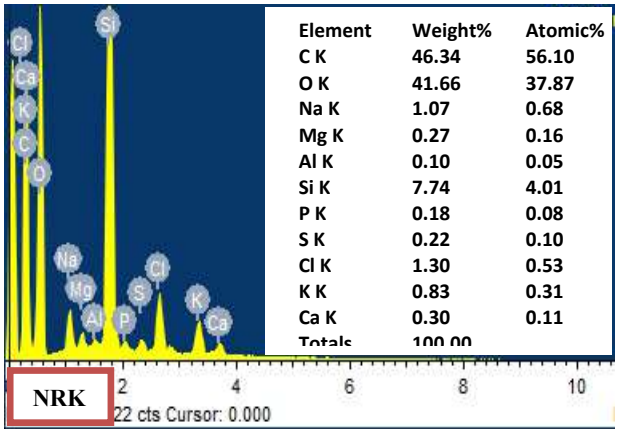
Plate - 9 EDS analysis of untreated and treated tannery effluent using coir pith and NRK on 4th day (Foliar)



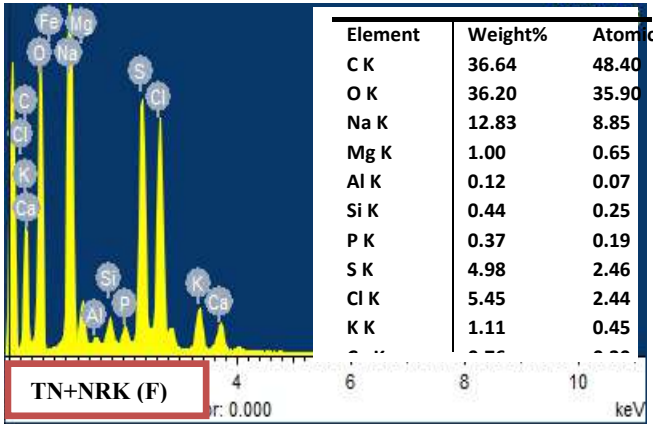
Element	Weight%	Atomic%
C K	10.50	16.09
O K	54.59	62.80
Na K	1.81	1.45
Mg K	0.86	0.65
Al K	7.07	4.82
Si K	15.34	10.06
S K	0.19	0.11
Cl K	1.29	0.67
K K	0.77	0.36
Ca K	3.66	1.68
Ti K	0.32	0.12
Fe K	3.61	1.19
Totals	100.00	



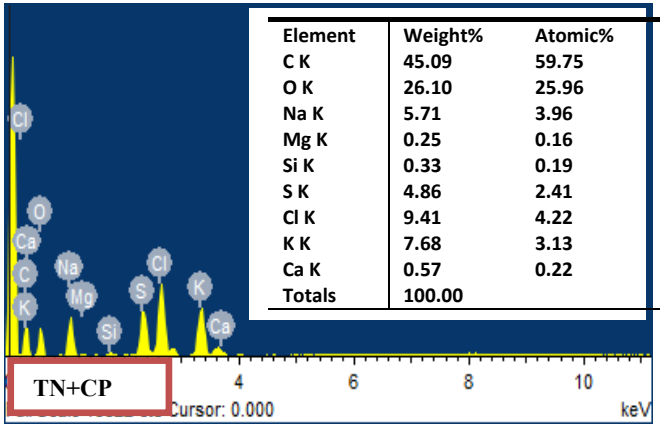
Element	Weight%	Atomic%
C K	16.56	24.73
O K	42.91	48.10
Na K	22.08	17.22
Mg K	0.49	0.36
S K	10.32	5.77
Cl K	7.20	3.64
K K	0.30	0.14
Cu K	0.15	0.04
Totals	100.00	



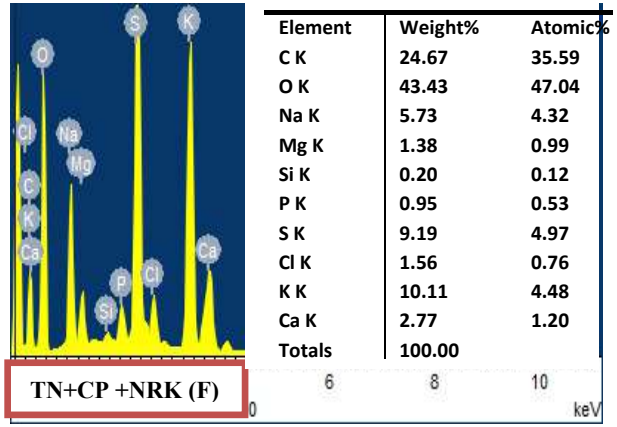
Element	Weight%	Atomic%
C K	46.34	56.10
O K	41.66	37.87
Na K	1.07	0.68
Mg K	0.27	0.16
Al K	0.10	0.05
Si K	7.74	4.01
P K	0.18	0.08
S K	0.22	0.10
Cl K	1.30	0.53
K K	0.83	0.31
Ca K	0.30	0.11
Totals	100.00	



Element	Weight%	Atomic%
C K	36.64	48.40
O K	36.20	35.90
Na K	12.83	8.85
Mg K	1.00	0.65
Al K	0.12	0.07
Si K	0.44	0.25
P K	0.37	0.19
S K	4.98	2.46
Cl K	5.45	2.44
K K	1.11	0.45



Element	Weight%	Atomic%
C K	45.09	59.75
O K	26.10	25.96
Na K	5.71	3.96
Mg K	0.25	0.16
Si K	0.33	0.19
S K	4.86	2.41
Cl K	9.41	4.22
K K	7.68	3.13
Ca K	0.57	0.22
Totals	100.00	

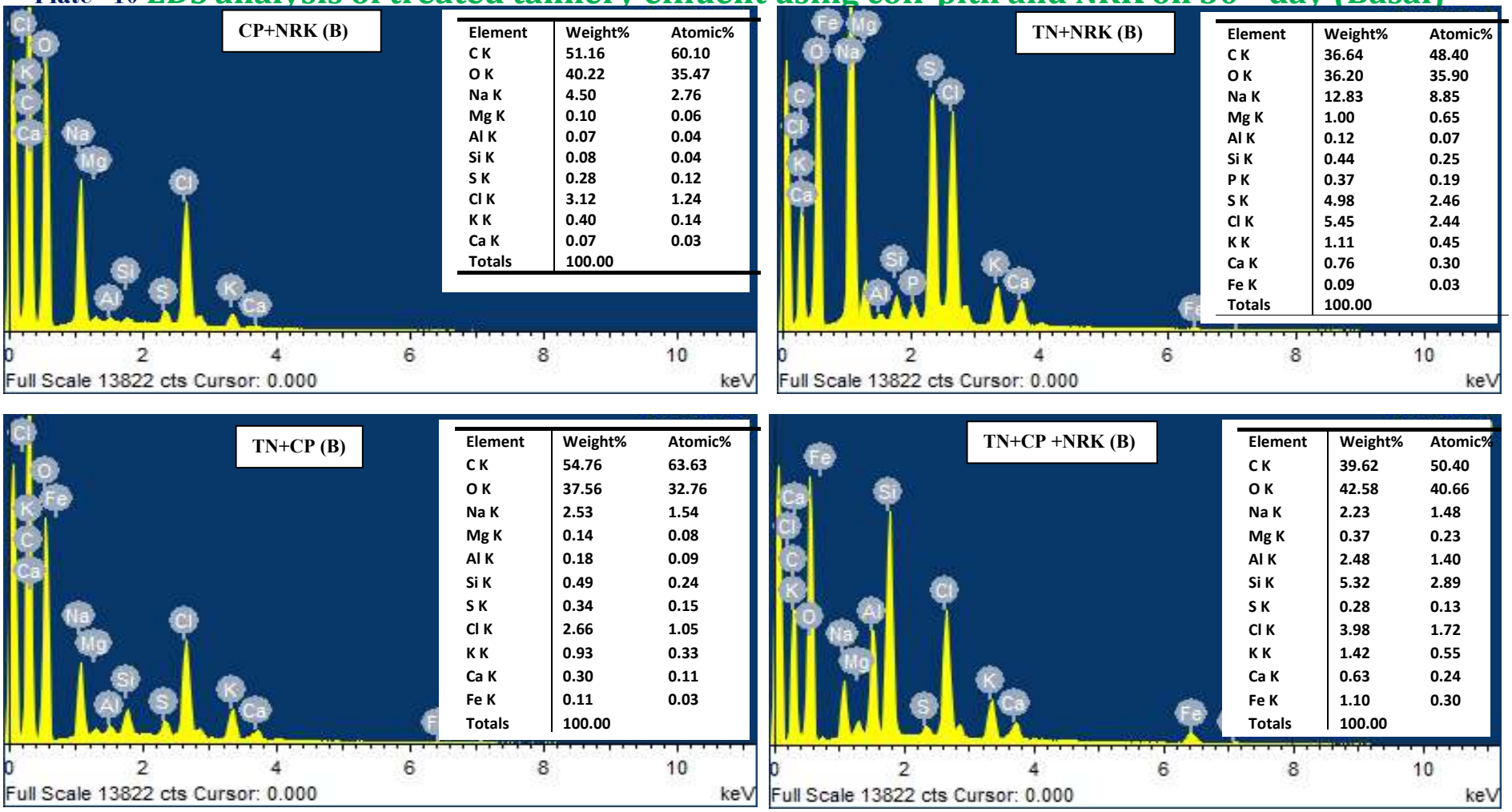


Element	Weight%	Atomic%
C K	24.67	35.59
O K	43.43	47.04
Na K	5.73	4.32
Mg K	1.38	0.99
Si K	0.20	0.12
P K	0.95	0.53
S K	9.19	4.97
Cl K	1.56	0.76
K K	10.11	4.48
Ca K	2.77	1.20
Totals	100.00	

TNS-Tannery Industry Soil, TNE-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal, F- Foliar

The EDS combined treated tannery effluent on 30th day was observed (pellet) **(Plate - 10).** It was showed the reduction of chemical compounds in combined treatment when compared with all other treatments.

Plate - 10 EDS analysis of treated tannery effluent using coir pith and NRK on 30th day (Basal)



TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal, B- Basal

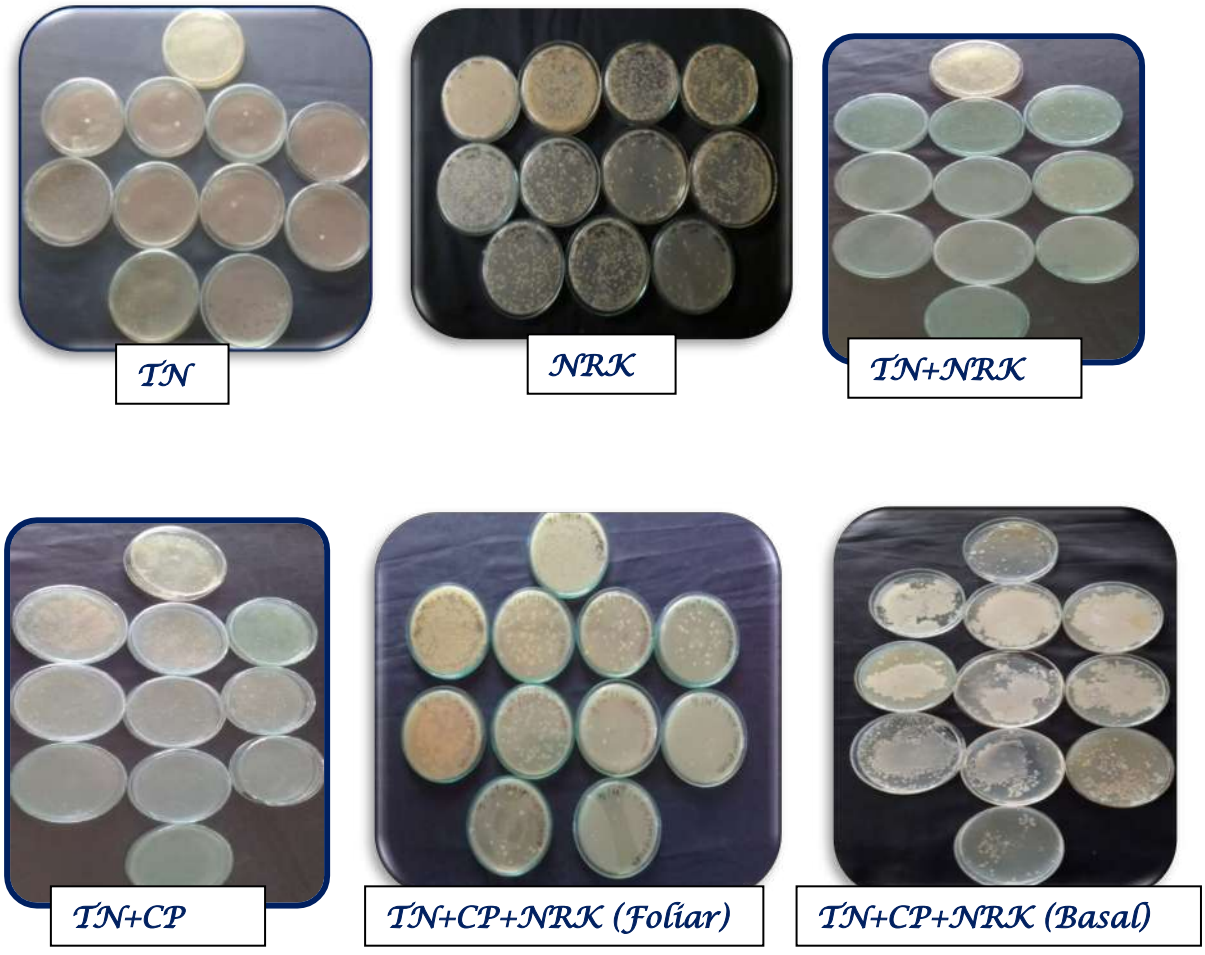
Experiment – II

Microbial Analysis

G) Microbial analysis in untreated and treated tannery effluent

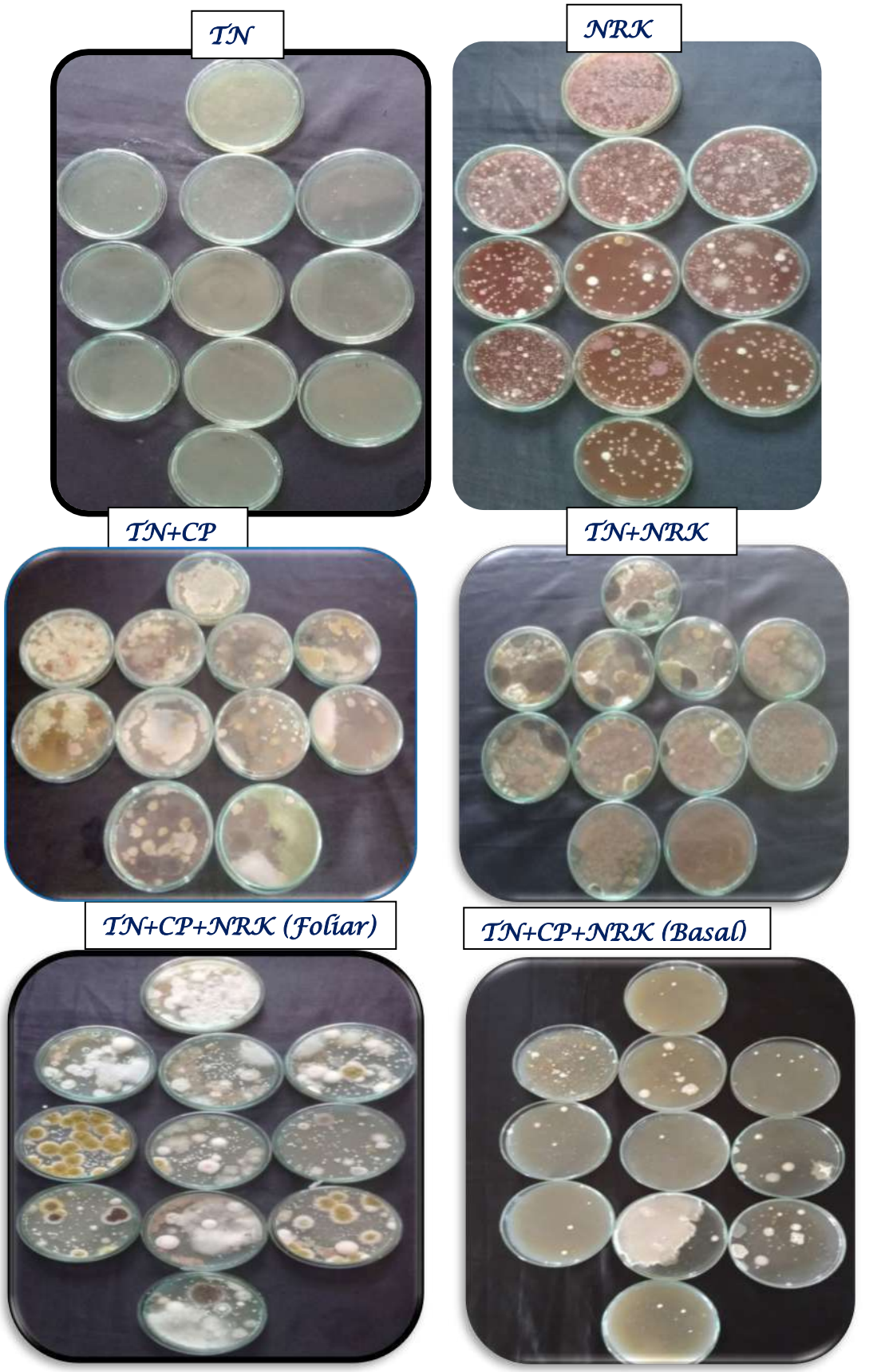
Plate - 11 & 12 showed the microbial flora (Bacteria & Fungi) of untreated and treated tannery effluent. More number of colonies was observed in combined treatment due to utilize the nutrient in coir pith and NRK (pellet & supernatant).

Plate - 11 ISOLATION OF BACTERIA FROM UNTREATED AND TREATED TANNERY EFFLUENT



TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

Plate – 12 ISOLATION OF FUNGI FROM UNTREATED AND TREATED TANNERY EFFLUENT



TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

H) Microbial analysis on soil (Initial)

Before applying the inorganic and organic fertilizer, the microbial flora (bacteria & fungi) was isolated in paddy field soil (**Plates - 13 & 14).**

Plate - 13 Isolation of soil bacteria from inorganic and organic fertilizers applied on *Oryza sativa* (Initial)

(Inorganic) (Organic) *(TN+CP+NRK)*

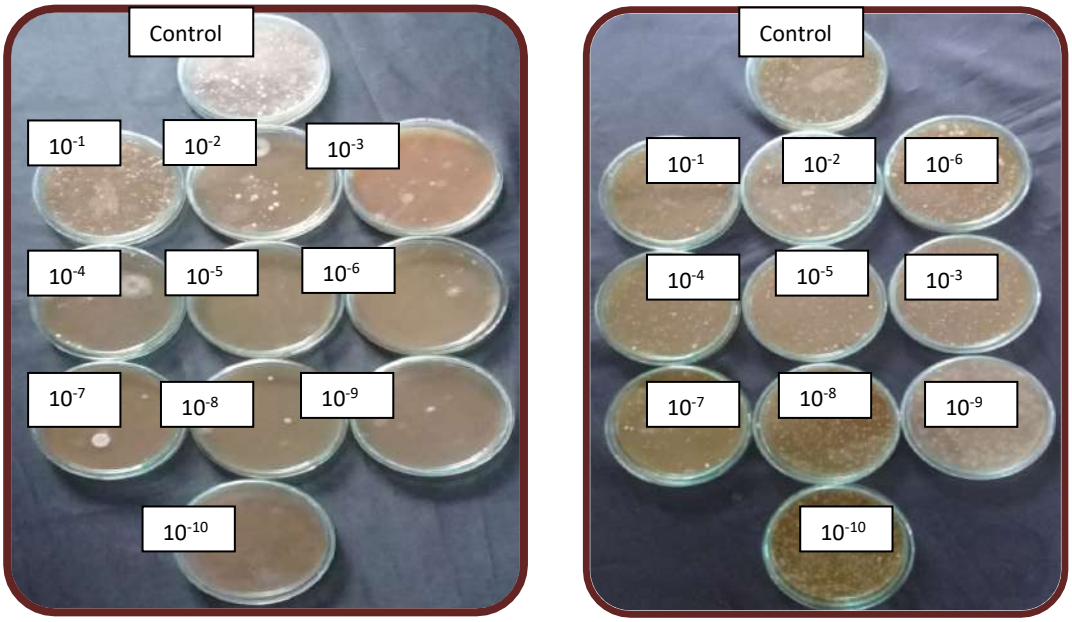
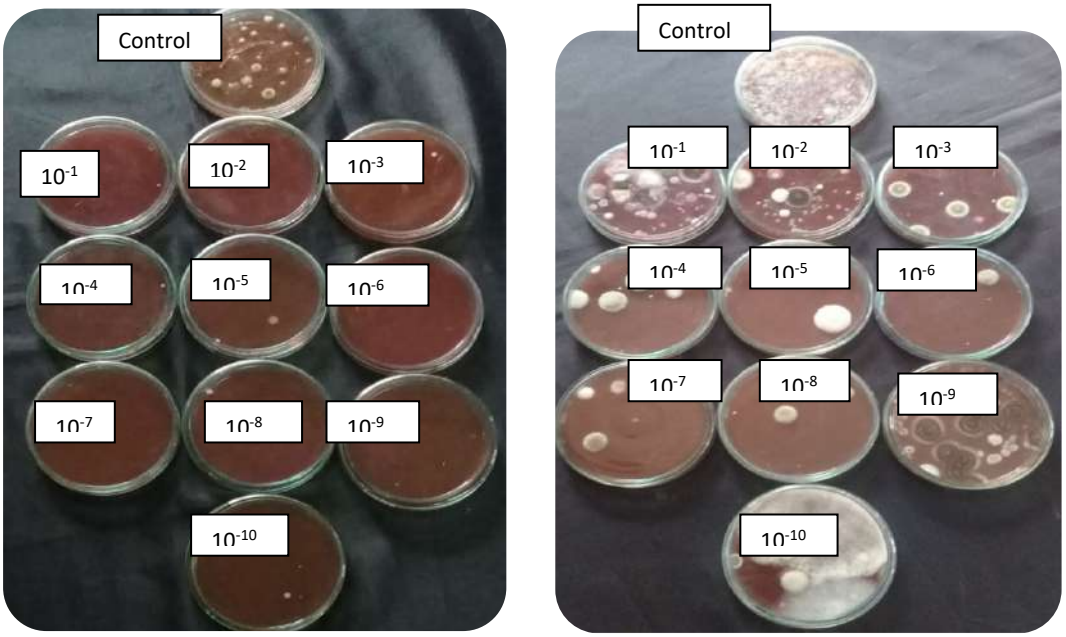


Plate - 14 Isolation of soil fungi from inorganic and organic fertilizers applied on *Oryza sativa* (Initial)

(Inorganic) *(Organic)(TN+CP+NRK)*



TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

Plates - 15 & 16 (banana field) shows the microbial flora (bacteria & fungi) of inorganic and organic fertilizers treated soil on initial day.

Plate – 15 Isolation of soil fungi from inorganic and organic fertilizers applied on *Musa acuminatae (Initial)*

(Inorganic) *(Organic)(TN+CP+NRK)*

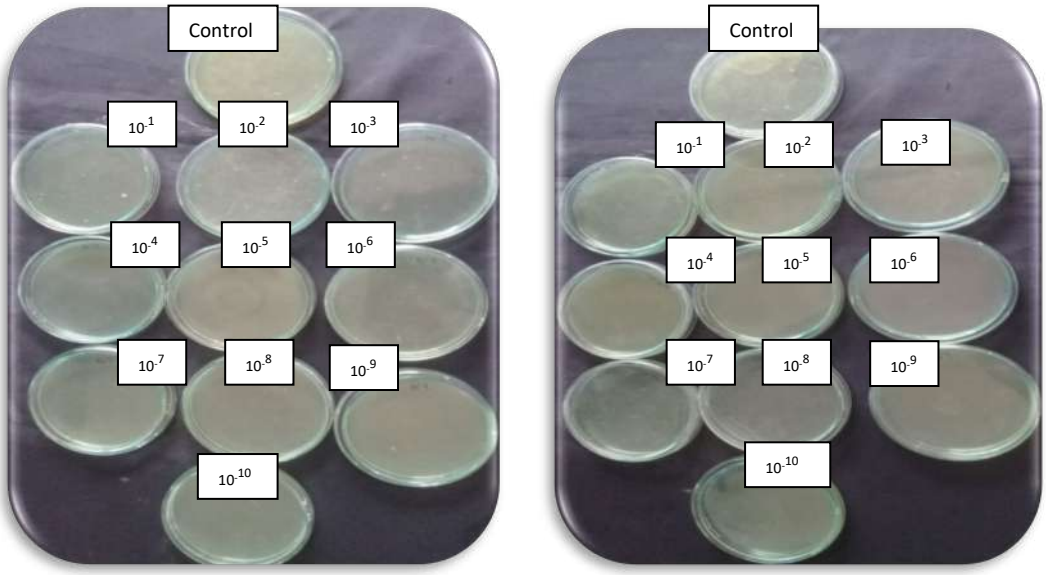
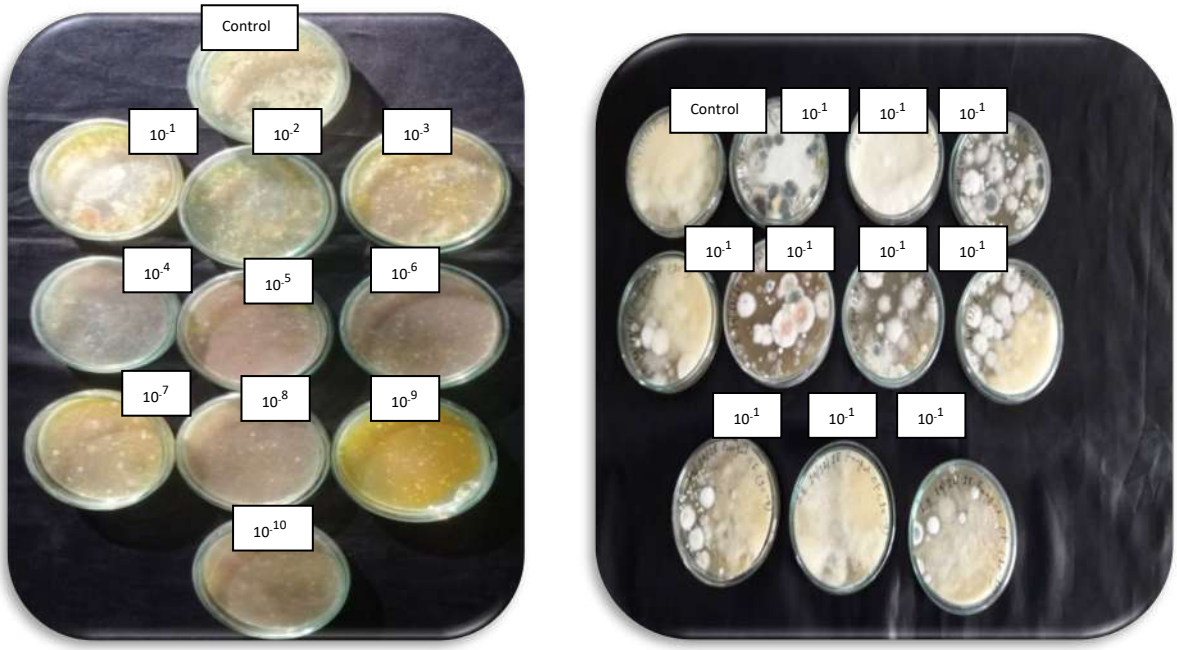


Plate - 16 Isolation of soil fungi from inorganic and organic fertilizers applied on *Musa acuminatae (Initial)*

(Inorganic) *(Organic)(TN+CP+NRK)*



TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

Table 2 & 3 shows colony forming unit (CFU) of bacteria and fungi isolated from paddy soil treated with inorganic and organic fertilizers.

Table - 2 *Total bacterial count in Paddy soil (Oryza sativa L)*

S.No	Dilutions	CFU	
		Inorganic	organic
1	10^{-1}	85×10^{-1}	80×10^{-1}
2	10^{-2}	25×10^{-2}	76×10^{-2}
3	10^{-3}	10×10^{-3}	70×10^{-3}
4	10^{-4}	3×10^{-4}	60×10^{-4}
5	10^{-5}	3×10^{-5}	30×10^{-5}
6	10^{-6}	3×10^{-6}	28×10^{-6}
7	10^{-7}	3×10^{-7}	25×10^{-7}
8	10^{-8}	2×10^{-8}	24×10^{-8}
9	10^{-9}	2×10^{-9}	23×10^{-9}
10	10^{-10}	1×10^{-10}	23×10^{-10}

Table - 3 *Total fungal count in Paddy soil (Oryza sativa L)*

S.No	Dilutions	CFU	
		Inorganic	organic
1	10^{-1}	0×10^{-1}	28×10^{1}
2	10^{-2}	0×10^{-2}	20×10^{2}
3	10^{-3}	0×10^{-3}	6×10^{3}
4	10^{-4}	1×10^{-4}	4×10^{4}
5	10^{-5}	1×10^{-5}	3×10^{5}
6	10^{-6}	0×10^{-6}	3×10^{6}
7	10^{-7}	0×10^{-7}	3×10^{7}
8	10^{-8}	0×10^{-8}	3×10^{8}
9	10^{-9}	0×10^{-9}	25×10^{9}
10	10^{-10}	1×10^{-10}	3×10^{10}

Table 4 & 5 shows colony forming unit (CFU) of bacteria and fungi isolated from banana soil treated with inorganic and organic fertilizers.

Table - 4 *Total bacteria count in Banana field*

S. No	Dilutions	CFU	
		Inorganic	organic
1	10^{-1}	50×10^{1}	72×10^{1}
2	10^{-2}	41×10^{2}	58×10^{2}
3	10^{-3}	36×10^{3}	44×10^{3}
4	10^{-4}	27×10^{4}	38×10^{4}
5	10^{-5}	17×10^{5}	29×10^{5}
6	10^{-6}	14×10^{6}	19×10^{6}
7	10^{-7}	11×10^{7}	14×10^{7}
8	10^{-8}	9×10^{8}	10×10^{8}
9	10^{-9}	6×10^{9}	9×10^{9}
10	10^{-10}	4×10^{10}	5×10^{10}

Table - 5 *Total Fungi count in Banana field*

S. No	Dilutions	CFU	
		Inorganic	organic
1	10^{-1}	63×10^{1}	49×10^{1}
2	10^{-2}	51×10^{2}	46×10^{2}
3	10^{-3}	42×10^{3}	45×10^{3}
4	10^{-4}	34×10^{4}	41×10^{4}
5	10^{-5}	25×10^{5}	36×10^{5}
6	10^{-6}	19×10^{6}	27×10^{6}
7	10^{-7}	15×10^{7}	20×10^{7}
8	10^{-8}	11×10^{8}	16×10^{8}
9	10^{-9}	8×10^{9}	12×10^{9}
10	10^{-10}	6×10^{10}	7×10^{10}

I) Microbial analysis on soil (Final)

Plates - 17 & 18 (paddy field) shows the microbial flora (bacteria & fungi) on soil treated with inorganic and organic fertilizers on final day. Bacterial and fungal colonies were increased in organic fertilizer (which was containing the nutrient) applied soil when compared with inorganic fertilizer applied soil.

Plate – 17 Isolation of soil bacteria from inorganic and organic fertilizers applied on *Oryza sativa* (Final)

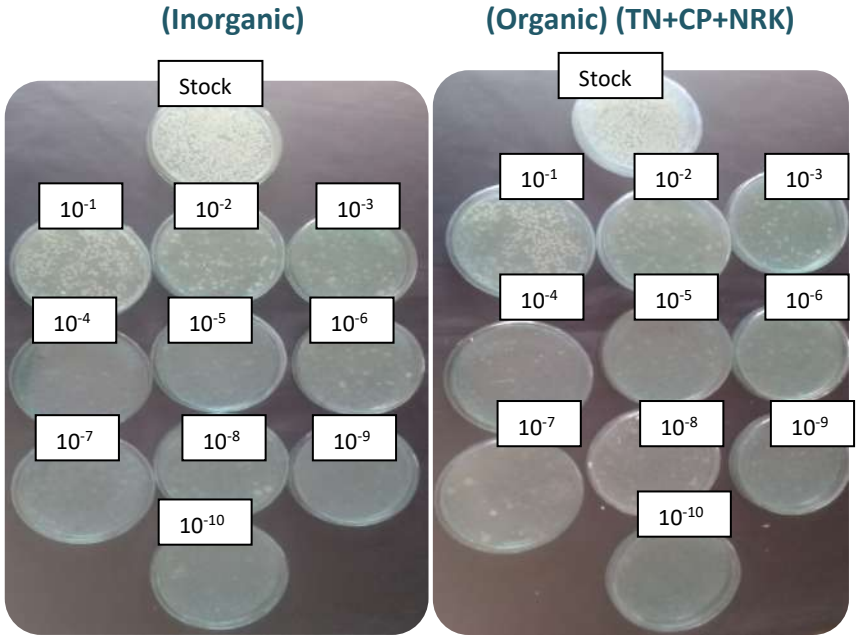
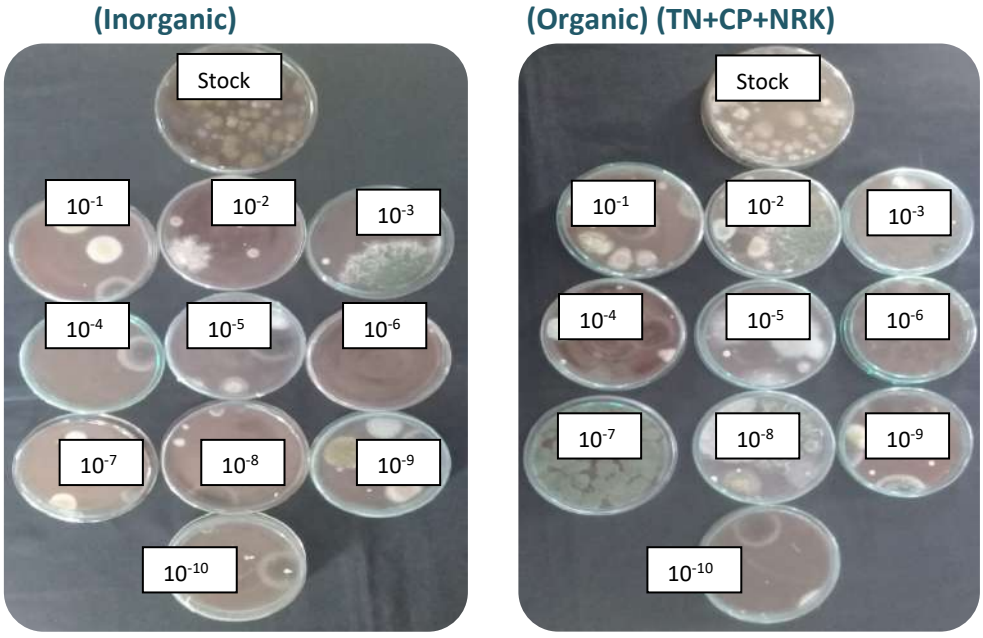


Plate - 18 Isolation of soil fungi from inorganic and organic fertilizers applied on *Oryza sativa* (Final)



TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

On final day (banana field) more number of microbial colonies was observed (bacteria & fungi) in organic fertilizer treated soil than inorganic fertilizer treated soil (**Plates - 19 & 20).**

Plate – 19 Isolation of soil bacteria from inorganic and organic fertilizers applied on *Musa acuminate* (Final)

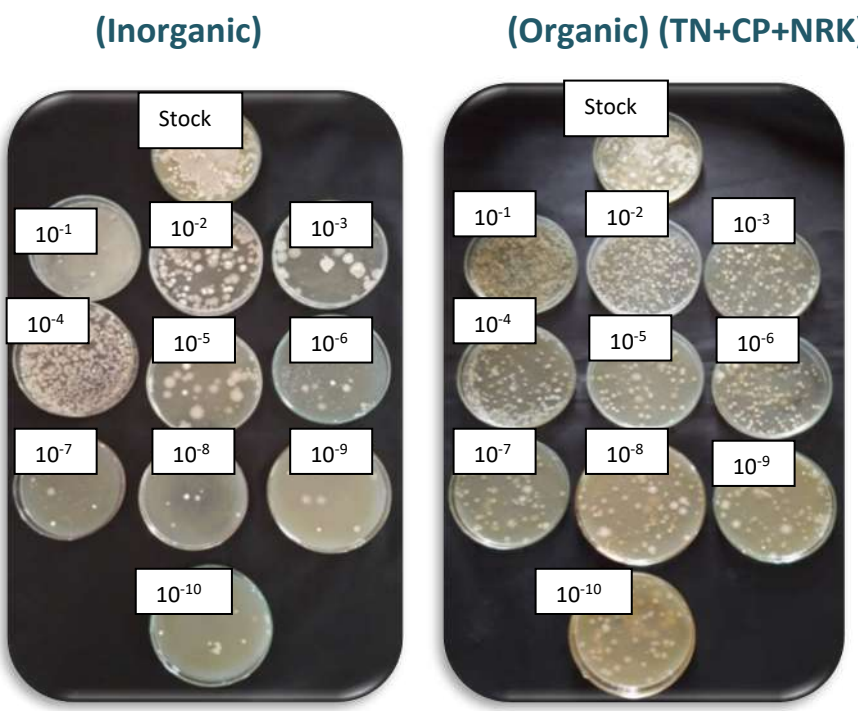
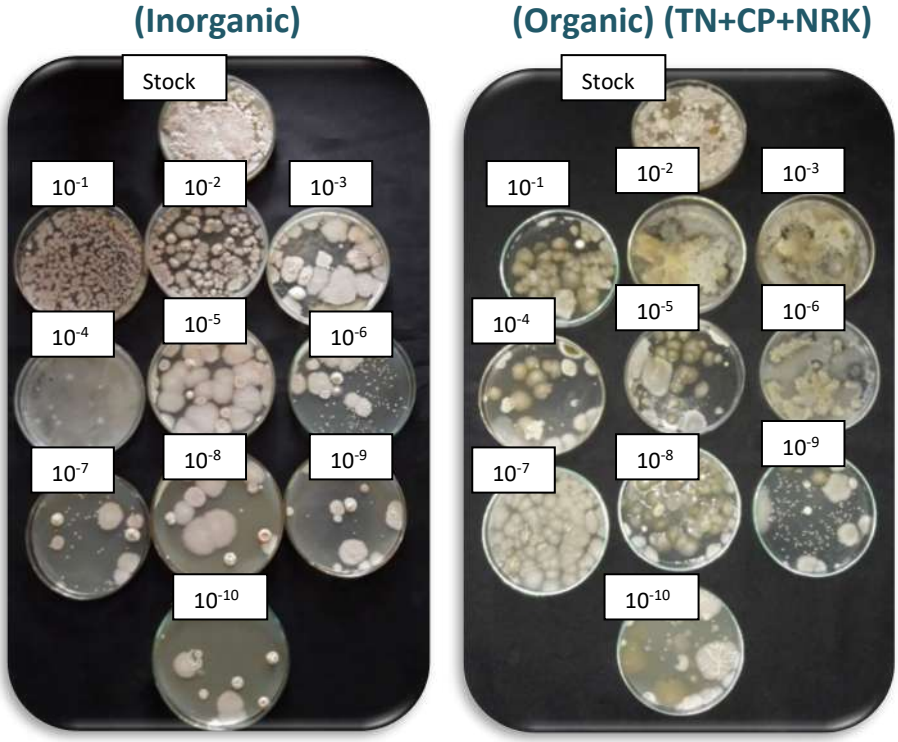


Plate – 20 Isolation of soil fungi from inorganic and organic fertilizers applied on *Musa acuminate* (Final)



TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

Table 6 & 7 shows more number of colonies of bacteria and fungi isolated from paddy soil treated with organic fertilizers due to presence of NRK compared to inorganic fertilizers.

Table - 6 *Total bacterial count in Paddy soil (Oryza sativa L)*

S.No	Dilutions	CFU	
		Inorganic	organic
1	10^{-1}	$\times 10^{-1}$	$\times 10^{-1}$
2	10^{-2}	147×10^{-2}	168×10^{-2}
3	10^{-3}	89×10^{-3}	106×10^{-3}
4	10^{-4}	65×10^{-4}	84×10^{-4}
5	10^{-5}	54×10^{-5}	73×10^{-5}
6	10^{-6}	47×10^{-6}	61×10^{-6}
7	10^{-7}	43×10^{-7}	54×10^{-7}
8	10^{-8}	38×10^{-8}	43×10^{-8}
9	10^{-9}	31×10^{-9}	36×10^{-9}
10	10^{-10}	23×10^{-10}	28×10^{-10}

Table - 7 *Total fungal count in Paddy soil (Oryza sativa L)*

S.No	Dilutions	CFU	
		Inorganic	organic
1	10^{-1}	6×10^{-1}	14×10^{-1}
2	10^{-2}	4×10^{-2}	24×10^{-2}
3	10^{-3}	23×10^{-3}	9×10^{-3}
4	10^{-4}	11×10^{-4}	15×10^{-4}
5	10^{-5}	8×10^{-5}	19×10^{-5}
6	10^{-6}	5×10^{-6}	7×10^{-6}
7	10^{-7}	5×10^{-7}	15×10^{-7}
8	10^{-8}	4×10^{-8}	19×10^{-8}
9	10^{-9}	7×10^{-9}	12×10^{-9}
10	10^{-10}	5×10^{-10}	6×10^{-10}

Table 8 & 9 shows more number of colonies of bacteria and fungi isolated from banana soil treated with organic fertilizers compared to inorganic fertilizers.

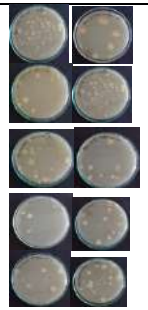
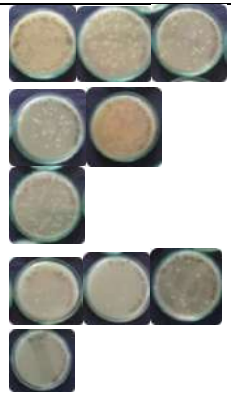
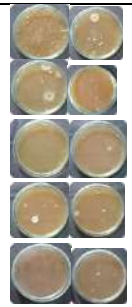
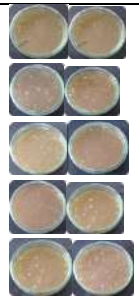
Table - 8 *Total bacterial counts in Banana soil (Musa acuminate)*

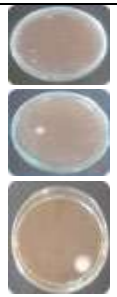
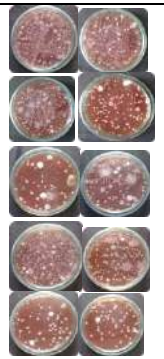
S.No	Dilutions	CFU	
		Inorganic	organic
1	10^{-1}	9×10^{-1}	84×10^{-1}
2	10^{-2}	55×10^{-2}	76×10^{-2}
3	10^{-3}	22×10^{-3}	58×10^{-3}
4	10^{-4}	72×10^{-4}	42×10^{-4}
5	10^{-5}	36×10^{-5}	31×10^{-5}
6	10^{-6}	25×10^{-6}	28×10^{-6}
7	10^{-7}	10×10^{-7}	21×10^{-7}
8	10^{-8}	9×10^{-8}	17×10^{-8}
9	10^{-9}	8×10^{-9}	13×10^{-9}
10	10^{-10}	6×10^{-10}	10×10^{-10}

Table - 9 *Total fungal counts in Banana soil (Musa acuminate)*

S.No	Dilutions	CFU	
		Inorganic	organic
1	10^{-1}	78×10^{-1}	73×10^{-1}
2	10^{-2}	63×10^{-2}	65×10^{-2}
3	10^{-3}	51×10^{-3}	54×10^{-3}
4	10^{-4}	20×10^{-4}	41×10^{-4}
5	10^{-5}	38×10^{-5}	39×10^{-5}
6	10^{-6}	27×10^{-6}	31×10^{-6}
7	10^{-7}	21×10^{-7}	25×10^{-7}
8	10^{-8}	15×10^{-8}	16×10^{-8}
9	10^{-9}	12×10^{-9}	13×10^{-9}
10	10^{-10}	9×10^{-10}	11×10^{-10}

Table- 10 Isolation of Bacteria & Fungi in all treatment and control

S.No	Microorganisms	Soil from TN industry ($10^{-4}10^{-5}10^{-6}$)	TN ($10^{-4}10^{-5}10^{-6}$)	NRK (10^{-1}…… 10^{-10})	CP ($10^{-4}10^{-5}10^{-6}$)	TN+NRK ($10^{-4}10^{-5}10^{-6}$)	TN+CP ($10^{-4}10^{-5}10^{-6}$)	TN+CP+NRK (10^{-1}…… 10^{-10})	Soil from Rice field and Banana field (10^{-1}…… 10^{-10})	
1	Bacteria (Control)									
	Supernatant									

	(Pellet)									
	No. of colonies (Control)		-	100	-					
	Supernatant					46	-	85	-	37
	(Pellet)							27		11
2	**Fungi (Control)**				-					

TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

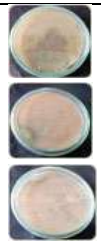
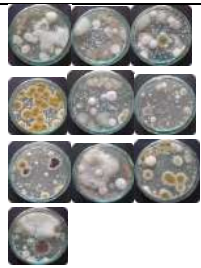
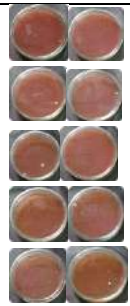
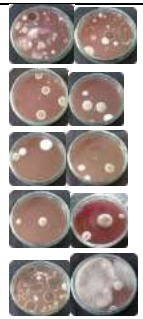
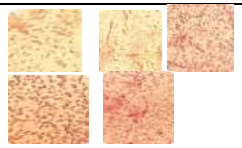
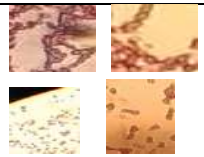
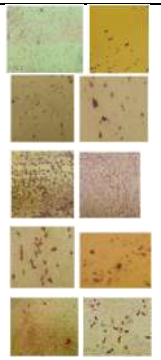
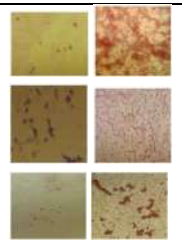
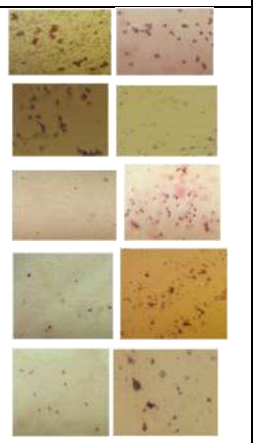
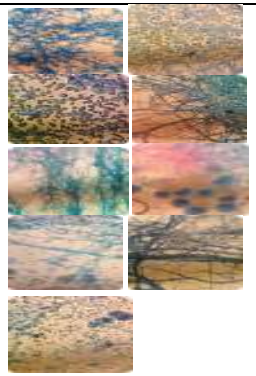
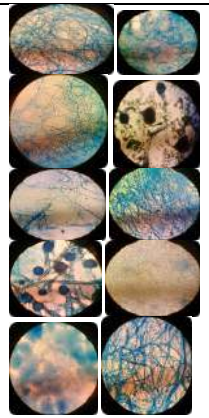
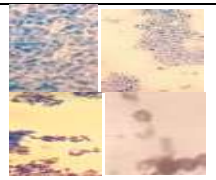
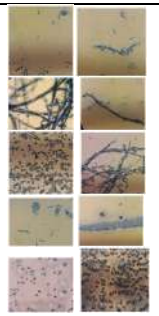
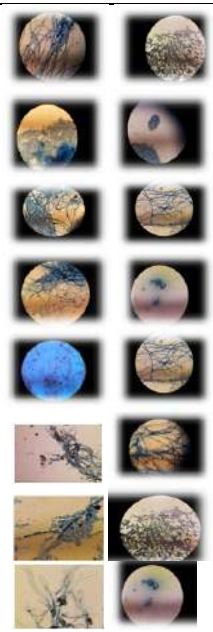
	Supernatant									
	Pellet									
	No .of colonies (Control)		-	12	-					
	(supernatant)					14	-	13	-	10
	(Pellet)							17		31

Table - 11 Microscopic view of Bacteria & Fungi in all treatments and control

S.No	Microorganisms	Soil from TN industry	TN	NRK	CP	TN+NRK	TN+CP	TN+CP+NRK	Soil from Rice field/ Banana field
1	Bacteria (Control)	- -	- -						
	Supernatant						- -		
	(Pellet)								

2	**Fungi** **(Control)**	- - - -	- - - -		- - - -				
	Supernatant						- - - -		

TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

	Pellet								

TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

Experiment – III

Seed germination, Pot study and Field trail

J) Different dilutions for seed germination

Plate – 21 to 25 showed the different dilutions of untreated and treated tannery effluent. The seed germination was carried out by different dilutions of supernatant.

Plate- 21 Different dilutions of untreated tannery effluent (TN)

Plate - 22 Different dilutions of tannery effluent treated with Navarasakaraisal (NRK)

Plate - 23 Different dilutions of tannery effluent treated with coir pith (TN + CP)

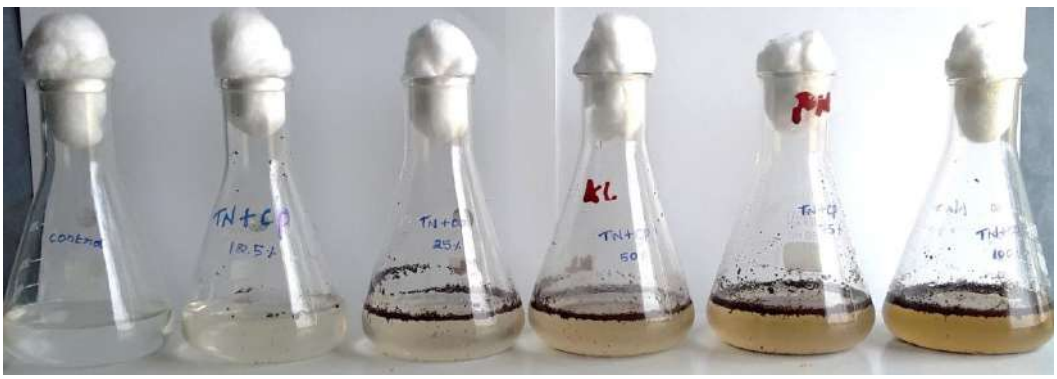


Plate - 24 Different dilutions of tannery effluent treated with Navarasakaraisal (TN + NRK)

Plate - 25 Different dilutions of tannery effluent treatedwith coir pith and Navarasakaraisal (TN + CP+NRK)

K) Seed germination on *Vigna radiata* L.

The seed germination study was carried out in different dilutions such as 12.5%, 25%, 50%, 75% & 100% of treated tannery effluent (supernatant) there was no germination in all the concentrations after 24 hrs. **(Plate - 26).** Better germination was observed in all concentrations after 96 hrs **(Plate - 27 & Fig - 1)**.

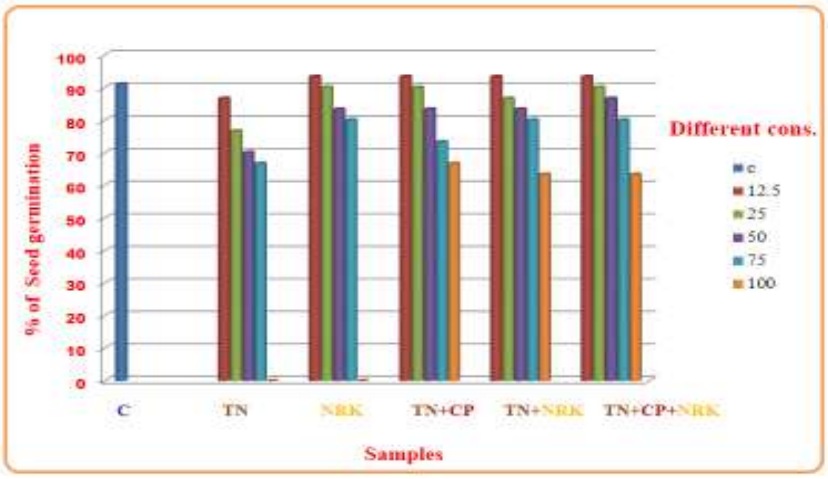
Plate – 26 **Effect of untreated and treated tannery effluent on seed germination of *Vigna radiata* L. (24 hrs)**

A. water, B. Tannery effluent, C. [illegible], D. Tannery effluent + Coir pith, E. Tannery effluent + [illegible], F. Tannery effluent +Coir pith+ [illegible]

Plate – 27 **Effect of untreated and treated tannery effluent on seed germination of *Vigna radiata* L. (96 hrs)**

A. water, B. Tannery effluent, C. [illegible], D. Tannery effluent + Coir pith, E. Tannery effluent + [illegible], F. Tannery effluent +Coir pith+ [illegible]

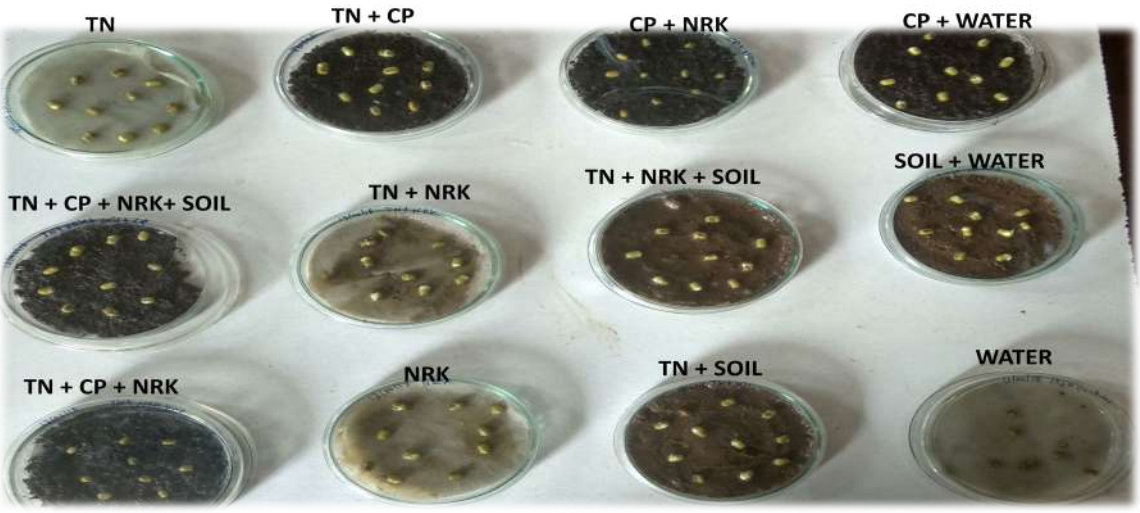
Fig -1 Effect of untreated and treated tannery effluent on seed germination of *Vigna radiata* L. (96 hrs)



C= Water, TN=Tannery Effluent, CP = Coir pith, NRK= Navarasakaraisal

The seed germination study was carried out in different treatments of treated tannery effluent (Pellet) such as TN+CP, CP+NRK, TN+CP+NRK, TN+NRK+SOIL, TN+CP+NRK+SOIL. There was no germination in all the concentrations after 24 hrs **(Plate - 28).**

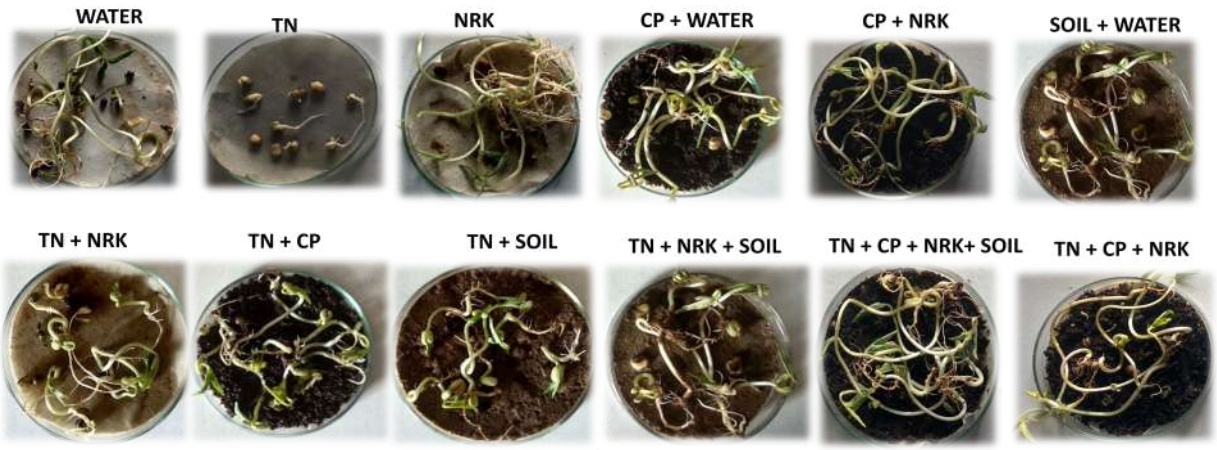
Plate – 28 Effect of untreated and treated tannery effluent (Basal)on *Vigna radiata*. L (24 hrs)



TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

100% of germination was observed in all the treatments after 96 hrs **(Plate - 29)**. Root and shoot length was increased in combined treatment when compared with other treatments.

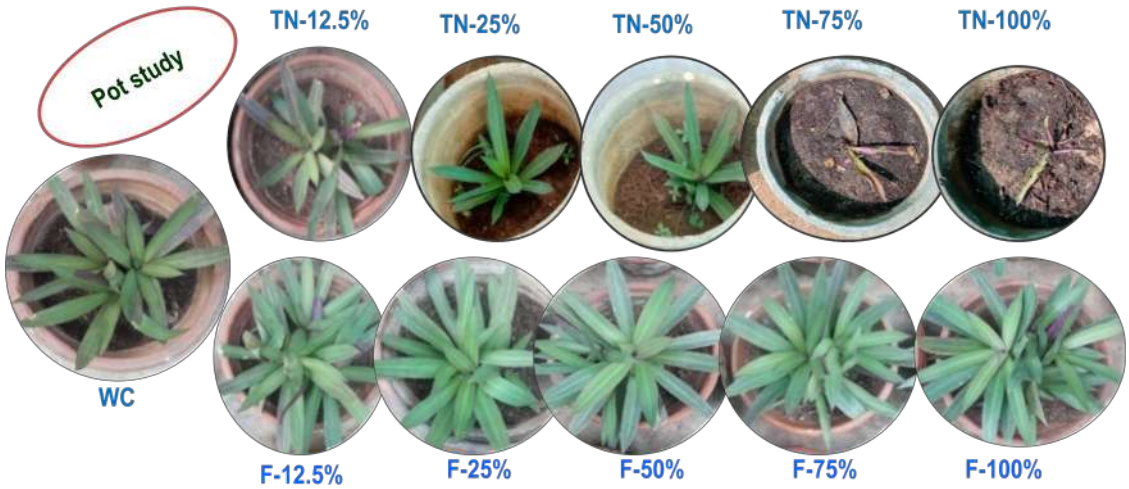
Plate – 29 Effect of untreated and treated tannery effluent on *Vigna radiata*. L (96 hrs)



L) Pot experiment on *Tradescantia spathacea*

After the seed germination a pot experiment was conducted to analyze the different dilutions (12.5%, 25%, 50%, 75% & 100%) of treated effluent on the plant *Tradescantia spathace* applied as foliar spray. On 15th day the tannery effluent applied plants were died in 75% and 100% due to heavy metals. But the plants were well grown in all concentrations of treated tannery effluent due to presence of coir pith and NRK (**Plate - 30**).

Plate – 30 Application of Foliar (TN+CP+NRK) on *Tradescantia spathacea* (15th day)



WC-water control, TN-Tannery effluent, F-Foliar spray

The pot experiment was conducted to analyze the different concentrations (10g, 20g, 30g....100g) of treated tannery effluent on the plant *Tradescantia spathace* applied as basal. **Plate - 31** shows that there was no negative effect on plant growth and developments on 30th day.

Plate – 31 Application of Foliar (TN+CP+NRK) on Tradescantia spathacea (30th day)

TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

M) Scaling up technology

The manure (Foliar and Basal) was prepared in bulk **(Plates - 32, 32a & 32b)** with respect to scaling up technology for field application as given below.

S. No	Type of Manure	TN (L)	CP(Kg)	NRK (L)
1.	Foliar	90	2	10
2.	Basal	50	50	5

Plate – 32 Preparation of organic manure for scaling up technology

32a) Basal **32b) Foliar**

TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

N) Application on Field (Paddy & Banana)

The **plates - 33 & 36** shows the application of organic fertilizer (Basal & Foliar) on paddy and banana field. The fertilizer was applied to the paddy field measuring approximately 12,000 sq. ft and banana field for totally 60 plants (30 Control and 30 Treatment).

Plate – 33 Effect of inorganic and organic fertilizer on Paddy (*Oryza sativa*) Field (0^{th} day)

Plate – 34 Application of Fertilizers (TN+CP+NRK) on Paddy field

TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

Plate - 35 Effect of inorganic and organic fertilizer (TN+CP+NRK) on Banana (*Musa acuminatae*) Field (0th day)

Plate – 36 Application of Fertilizers (TN+CP+NRK) on Banana field

TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

Plate - 37 showed the application of organic fertilizer (Basal & Foliar) on different plants such as brinjal, pumpkin, snake guard & ridge guard, etc.,

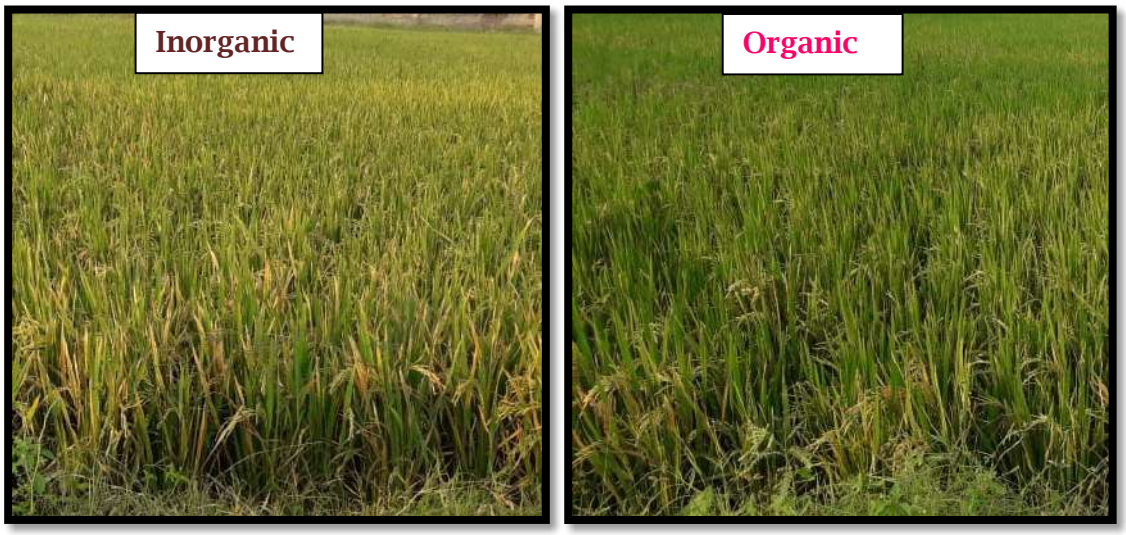
Plate - 37 Application of Organic Fertilizer on different plants

O. Analysis of growth and yield

i) Paddy (*Oryza sativa L.*)

Plate - 38 shows the yield of paddy field with respect to inorganic and organic fertilizer on 3rd month.

Plate - 38 Effect of inorganic and organic fertilizer (TN+CP+NRK) on Paddy (*Oryza sativa*) Field (3rd month)



The quantity of harvested paddy was found to be 441kgs for inorganic and 476kgs for organic fertilizers **(Plate - 39)**.

Plate - 39 Yield of inorganic and organic fertilizer (TN+CP+NRK) on paddy field (*Oryza sativa*)

TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

Plate - 40 exhibited the rough soil nature in inorganic and smooth soil nature in organic fertilizer after harvesting.

Plate – 40 Effect of inorganic and organic fertilizer (TN+CP+NRK) on Paddy (*Oryza sativa*) Soil after harvesting (3rd month)

Inorganic soil **Organic soil**

The root length was increased in organic fertilizer (containing nutrients) when compared to the organic fertilizer **(Plate - 41).**

Plate - 41 Effect of inorganic and organic fertilizer (TN+CP+NRK) on root length of Paddy

TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

ii) Banana (*Musa acuminate)*

Plate - 42 showed that the growth and yield of banana plant. The plants (which organic fertilizer was applied) showed satisfactory growth with respect flowers and fruits when compared to inorganic fertilizer.

Plate - 42 Growth and yield of *Musa acuminate* (Banana plant) applied with inorganic organic fertilizer

TN: Tannery; CP: Coir pith; NRK: Nava Rasa Karaisal; CF: Chemical Fertilizer; OF: Organic Fertilizer

After applying the fertilizer more number of earthworms were found in the organic fertilizer (Basal & Foliar) applied soil and its large size due to the presence of microorganisms in NRK (**Plate - 43).**

PLATE - 43 Effect of inorganic and organic fertilizer on earthworm (*Lumbricus terrestris*)

P. Development of Research & Training centre

A green shed was constructed in Model Organic Farm (MOF) at Bharathidasan University, Tiruchirappalli-24, Tamil Nadu to carry out the research activities related to treatment of tannery effluent using coir pith and microorganism **(Plate - 44)**.

Plate - 44 Green shed

SUMMARY

- **The physicochemical parameters in all treatments were considerably reduced in treated tannery effluent.**
- **The degradation of tannery effluent confirmed by SEM & EDS.**
- **The microorganisms were found more no.of colonies in treated tannery effluent (Basal & Foliar) than untreated tannery effluent.**
- **The seed germinations were improved in basal (100%) and foliar (12.5%) on Vigna radiata. L.**
- **The Growth was improved in applied field of paddy and banana.**
- **The microbial flora (bacteria & fungi) of the soil treated with tannery effluent (Basal & Foliar) were improved in paddy & banana filed.**
- **More no.of earthworms were found in organic fertilizer applied banana soil than inorganic fertilizer applied soil.**
- **The Green Shed was constructed in Model Organic Farm at Bharathidasan University for Research and Training purpose.**

*****

Detailed Procedure

Coir pith compost using tannery effluent and NRK for preparation of I MT manure

Submitted to

Central Coir Research Institute

Kalavoor. P.O, Alappuzha 688 522

Kerala, India.

Dr. P. MALLIGA

Professor and Head

Dept. of Marine Biotechnolo

Bharathidasan University

Tiruchirappalli-24

NRK- Navarasa Karaisal preparation 100/ L

Table- 1

COMPOSITION	CONTENT
Cow dung	10 kg
Cow urine	1 L
Milk	2 ltrs
Besan flour	2 kg
Curd	2 ltr
Jaggery	2 kg
Ghee	100 gm
Banana	12 pcs
Yeast/ Soil	100gms

Preparation of NRK

Preparation of NRK by mixing five products of cow along with the other ingredients **(Table-1**). To the 100L of water in a barrel cow dung, cow urine, milk, curd and ghee were added and mixed well. This was followed by addition of jaggery, gramflour, banana and hand full of yeast or fertile soil. The preparation should be placed in a shaded place for 2-7 days and stirred well twice a day (morning and evening) for fermentation. The barrel should be covered with a cloth/net to avoid contamination from other sources and aeration.

Preparation of manure

Mix 250 kg of coir pith with 1000L of tannery effluent (Plate -1) and 25 L of NRK (Plate -2) in a tank and cover with polythene sheet (Plate-3). Incubate for 30 days and the final product will be 1 MT. This can be mixed with 200kg of poultry manure for nitrogen supplement(Plate-4).

(**Plate -1**) Tannery effluent 1000L

Plate-2 Treatment in closed tank TN+CP+NRK –mix well and incubate for 30 days (yield 5MT)

Tannery Effluent (TN) 1000L

Coir pith (CP) 250 kg

Nava Rasa Karaisal (NRK) 25L

Plate -3

PLATE 4: Treatment of Coir pith and NRK with tannery effluent (1 M.T)

(For Enrichment add 200 kg of poultry manure)

TN-Tannery Effluent, CP-Coir Pith, NRK- Nava Rasa Karaisal

Application

1 MT/ acre, 5 kg / tree, 30gms / pot

Total Cost of NRK Preparation (100L):

Composition	Content	Amount (₹) (Approx.)
Cow dung	10 kg	100
Cow urine	1 ltr	50
Milk	2 ltr	50
Besan flour	2 kg	90
Curd	2 ltr	240
Jaggery	2 ltr	300
Ghee	100 gm	70
Banana	12 pcs	100
Handful of soil	-	-
Total		1,000

Total Cost of Manure Preparation: Will vary from place to place

S. No	Particulars	Quantity	Amount (₹)
1.	Coir pith	200Kg	600
2.	NRK	20L	200
3.	Tannery	1000L	500
4.	Poultry	200Kg	500
5.	Polythene Sheet (20x20)	1 Pac.	1,000
6.	Manpower	1	1,400
		Total	4,200

Demonstration at Central Coir Research Institute

The Bharathidasan University, Tiruchirappalli- 620024 was conducted the demonstration of organic manure production using Coirpith, Nava Rasa Karaisal and Tannery waste at Central Coir Research Institute (CCRI) Campus, Alappuzha, Alleppey, Kerala-688522 on 2-3, December, 2020 regarding the project entitled""“Development of research and training centre for tannery waste treatment using coir pith and effective microorganism to convert it in to organic manure” in the presence of Review Committee members.

Following ingredients were used the above demonstration;

S.No	Ingredients	Weight (Kgs)
1	Coirpith (200kgs)	600
2	Tannery waste	200
3	Poultry	200
4	Nava Rasa Karaisal	20
	Total	1020

Demonstration at Central Coir Research Institute, Kalavoor, Alleppey

Tannery waste treatment using coir pith and effective microorganism (NRK) to convert it into organic manure

Mixing Coir pith, Tannery & Poultry

Preparation of NRK

Application of NRK

Covered with polythene sheet

Tannery waste treatment using coir pith and effective microorganisms to convert it into organic manure

DEPARTMENT OF MARINE BIOTECHNOLOGY
Bharathidasan University
Tiruchirappalli – 620 024, Tamil nadu, India

Report on

One Day Training cum demonstration Programme on

Treatment of Tannery waste using Coir pith and effective microorganisms to convert it into organic manure

Presented to

CENTRAL COIR RESEARCH INSTITUTE
Coir Board, (Ministry of MSME) **Govt. of India**
Alappuzha - 688 522, Kerala, India

by

Dr. P. MALLIGA
Professor, Department of Marine Biotechnology,
Bharathidasan University, Tiruchirappalli-24
E-mail: malliga.p@bdu.ac.in

October-2021

BDU-COIR BOARD TRAINING PROGRAMME REPORT

Development of research and training center for tannery waste treatment using coir pith and effective microorganisms to convert it into organic manure

Department of Marine Biotechnology, Bharathidasan University, Tiruchirappall-24 conducted one day training programme on "Treatment of tannery waste using coir pith and effective microorganisms to convert it into organic manure" held on 06.10.2021 as a part of the project entitled "**Development of research and training center for tannery waste treatment using coir pith and effective microorganisms to convert it into organic manure".** In the programme twenty three industry representatives participants attended the training programme from varies districts of Tamil Nadu such as Chennai, Coimbatore, Pollachi, Dharmapuri, Pudukottai, Pattukottai, Dindigul, Thanjavur, Erode, Karur, Tiruchirapalli and Bangalore.

Further, five participants were connected through zoom meet online platform from Tamil Nadu and West Bengal also participated both in presentation and demonstration processes. Around twenty Student entrepreneurship participants from various departments of Bharathidasn University also took part in the training cum demonstration programme.

Dr. P. Malliga, the Principal Investigator has explained the research and Development of the project and theoretical background of the technology at National Facility for Marine Cyanobacteria (NFMC), Bharathidasan University, Tiruchirappalli.

Dr. B. Radhakrishnan presented the Coir Board and CCRI research projects and developments, schemes, facilities and services to the society. In the afternoon session PI explained and exhibited the demonstration on at Model Organic Farm (MOF), Bharathidasan University, Tiruchirappalli. In this demonstration programme, preparation of effective microorganisms (Nava Rasa Karaisal) and mixing of coir pith and tannery effluent for conversion of manure has been done in front of all participants. Finally, discussion was made by the participants with Dr. P. Malliga, Dr. B. Radhakrishnan, Mr. G. Poopalan about role of coir pith and tannery waste decomposition by microbial consortium and vote of thanks proposed by Mr. K. Malkar Dindigul.

Feedback form report as follows:

Out of fifty participants thirty participants given a feedback mentioned as good, useful and informative training programme. Some of the participants asked to submit results of the reports done at Bharathidasan University to have for their references. Tannery industry representatives have taken composted manure sample for lab test and analysis. Student from different departments also informed as useful, innovative and informative training programme.

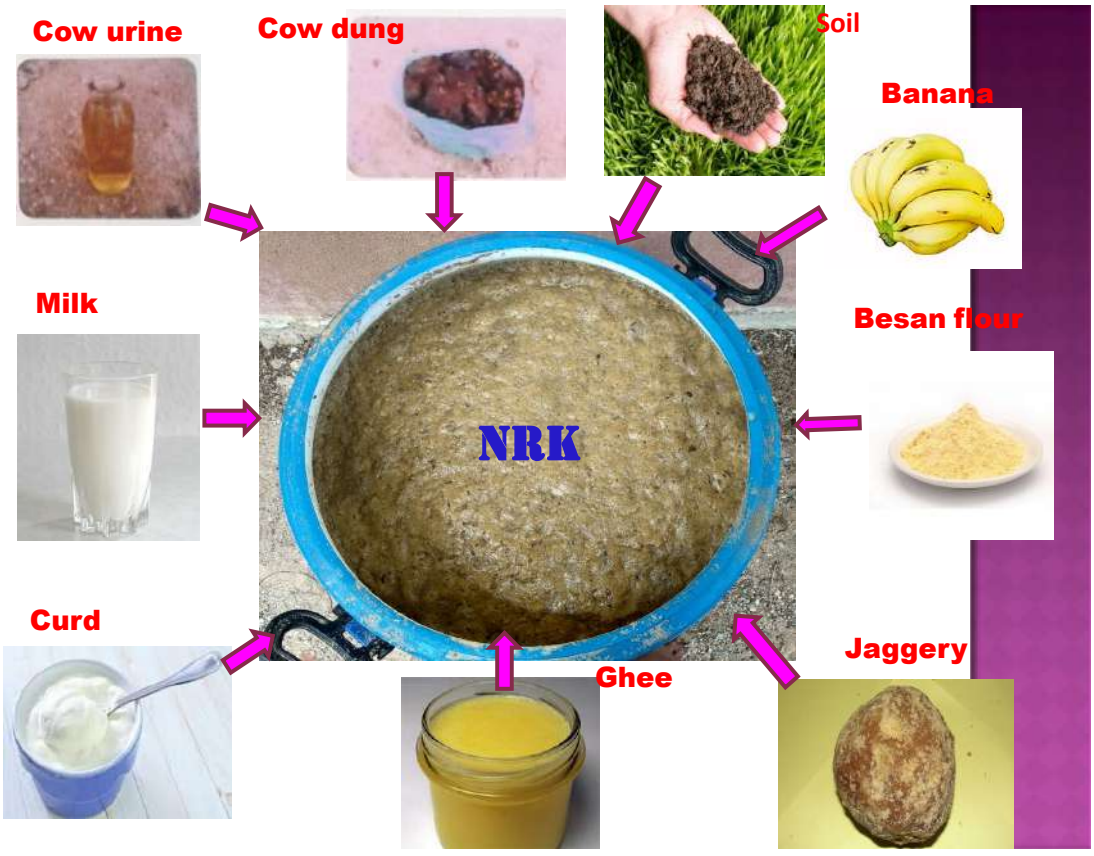
Encl:

1. List of participants- Ann-II
2. Attendance list - Ann. III
3. Feedback form - Ann. IV
4. Invitation - Ann. I
5. Certificate - Ann. V

Composition of Nava Rasa Karaisal (100L)

COMPOSITION	CONTENT
Cow dung	10 kg
Cow urine	1 L
Milk	2 ltrs
Besan flour	2 kg
Curd	2 ltr
Jaggery	2 kg
Ghee	100 gm
Banana	12 pcs
Yeast/ Soil	100gms

Preparation of Nava Rasa Karaisal (100L)



Training Programme Activities

Presentation in NFMC

Participants

Discussion about the Presentation

CCRI-Presentation

Demonstration


Participants in Model Organic Farm

Discussion about the Demonstration

Group Photo with Organic Manure

DEPARTMENT OF MARINE BIOTECHNOLOGYBHARATHIDASAN UNIVERSITY

Tiruchirappalli – 620 024, Tamil Nadu, India

&

CENTRAL COIR RESEARCH INSTITUTE

COIR BOARD

Alappuzha - 688 522, Kerala, India

We cordially invites you a One Day Training Programme on

Treatment of Tannery waste using Coir pith and effective microorganisms to convert it into organic manure

Date : **06.10.2021** (*Wednesday)*

Venue: **Bharathidasan University**

Model Organic Farm

Opp. Ladies Hostel

Organized by

Dr. P. MALLIGA
Professor and Head, Department of Marine B iotechnology,
Bharathidasan University, Tiruchirappalli-24
E-mail: malliga.p@bdu.ac.in

Treatment of Tannery waste using Coir pith and effective microorganisms to convert it into organic manure

Agenda

Time	Programme
10.30am -11.00am	Registration
11.00am-11.45am	PPT Presentation
11.45am-12.00pm	Tea break
12.00pm-01.30pm	NRK preparation
01.30pm-02.30pm	LUNCH break
02.30pm- 03.30pm	Demonstration (Manure preparation)
03.30pm-03.45pm	Tea break
03.45pm-04.00pm	Discussion

DEPARTMENT OF MARINE BIOTECHNOLOGY
BHARATHIDASAN UNIVERSITY
Tiruchirappalli – 620 024, Tamil Nadu, India
&
CENTRAL COIR RESEARCH INSTITUTE
Coir Board, (Ministry of MSME) Govt. of India
Alappuzha – 688 522, Kerala, India

List of Participants

S. No	Name	Address
1	S. Thilakar	Thilak Traders, Poovanam, Pattukottai
2	V.P. Venketesan	Indeed Coporation, Coimbatore-641030
3	M. Rakkiyannam	Grow Compost, Srivari Enterprise, Sathyamangalam
4	A. Sudha	1/7k5, Palacoderoaf karimangajam, Dharmapuri-635111
5	I.John Kennedy	S\O S.Innasimuthu, 1\1 kambar Street Alangudy, Pudukottai
6	AJ. Shameen Ahmed	258\CAT, Wadi Road, Melvisharam ,Tamilnadu
7	Azharuddin	56, periama maistry st, peviamet, Chennai-3
8	M.Sivakumar	Shine Coir Industy, 13\7k, Palacode Road, Karimangalam, dharmapuri-Dt,Tamilnadu
9	V.Rayaz Ahmed	KH. Export Ind.PVT lim, KH Groups,P17, MBT Road ,Ranipet
10	S. Julius	79\3, Salai Road Extn, JK Towers, First Floor, Thillai Nagar, Trichy-18
11	P. Tamilselvan	E.K.H.m and Sons, 1-8, B.P.Asraharam, Erode
12	V.Harini	62, Nehru Nagar, Ondipudur, Coimbatore
13	K.Sathiyan	Coir Board, Thanjavur
14	M. Manivannan	Saai Coirs , Sengipatti
15	K.Malkar Sayan	Dindigul Coir Association
16	V. Deepa	South Street, Sengipatti, Thanjavur.
17	S.Lenin	9190\22\1, Vinayaga Nagar,pandalgudi
18	E. Kayalvizhi	106-4th Cross ,Vasanthanagar, 2ND Jaynagar,Karumandapam,Trichy.
19	A.Sivaranjani	1/486, Pookollai,Peravurani, Thanjavur.
20	R.Dinesh kumar	South mettur Street, Vettaikkaran pudur, Pollachi.
21	S.Sugan Joshi	1/59, Pathirpatti, karur-621313.
22	R. Sivasakthivel	II MSC, MBT
23	R. Hariprasath	II MSC, MBT
24	Somdutta Dakshy	II MSC, MBT
25	G. Anbalagan	Saai Coirs , Sengipatti
26	R. Asai Thambi	BHEL
27	Prasana Kumar	B, love
28	G.Poopalan	Coir Board ,Pollachi
29	Dr. S.Radhakrishnan	Senior, Scientific Officer, CICT
30	K.Vinotha	DBT- Inspire Research Scholar,BDU
31	S.Selvapriya	R/S, BDU
32	V.Sangeetha	JA,NFMC, BDU
33	T.S.Sureka	JRF, R/S, NFMC, BDU
34	E .Kaviya	II MSC, MBT

35	V.Veeramurugan	II MSC, MBT
36	D.Kartheeswaran	II MSC, MBT
37	G.Sudhe	II MSC, MBT
38	Kumari Riya	II MSC, MBT
39	Soniya Gupta	II MSC, MBT
40	Gourau Chakraborty	II MSC, MBT
41	S.Sai Mahesh Kumar	II MSC, MBT
42	Mainak Roy	II MSC, MBT
43	Shrestha Dutla	II MSC, MBT
44	R.Saran	II MSC, MBT
45	M.Subha Lakshimi	II MSC, MBT
46	Arijit alukdar	II MSC, MBT
47	T. Kumaravel	II MSC, Biotechnology, National College, Trichy
48	S.Yoganathan	II MSC, Biotechnology , National College, Trichy
49	K.Maheswaran	II MSC, Biotechnology , National College, Trichy
50	S. Suriyanath	II MSC, Biotechnology , National College, Trichy
51	S.Kaviyarasan	JRF, MBT

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Coir Board, (Ministry of MSME) Govt. of India
Alappuzha – 688 522, Kerala, India

One Day Training Programme on "Treatment of Tannery waste using Coir pith and effective microorganisms to convert it into organic manure

Attendance

S. No	Name	Address	(Mobile No. & Email ID	Sign
1	S. THILAGAR	THILAK TRADERS PODVANAM, PATTUKOTTAI	9500843686 Sevensudia 786@gmail.c	
2.	V. P. Venkatachalam	Indeneed Corporation Coimbatore - 641030	9443349159 indeneed@gmail.com	
3.	Rakkiyannan. M	C Grow Compost Sri Vari Eakati Sathyamangalam.	9886315256 mrakkiyannan@gmail.com	
4.	A SUDHA	13/7K5, PALACODE ROAD KARIMANGALAM, DHARMAPURI - 635111	9655544920 sugisudha14@gmail.com	
5.	I JOHN KENNEDY	S/O. S. Ianasimuthu 1, Kamban 8th road Alangudy Pudukkottai	9698550008 JK2TO61985@gmail.com	
6.	SHAMEEN AHMED A)	#258 KATHADI ROAD MECHERI	9042865315 shameemy@gmail.com	
7.	Azharuddin	56, Periarra maistry st, Periamet, Ch 3	9789901601 INKoleathers@gmail.com	

S. No	Name	Address	(Mobile No. & Email ID	Sign
8.	M. Sivakumar	Shine coir industry 13/7B, Palacode road, Nallimangalam, Dharmapuri - dt, TN	9786707000 shiva@shinecoir.com	
9.	V. RIYAZ AHMED	K H Exports Pvt. Ltd. KH Group 117, M.B.T. Road, Ranipet	9894331663 tannery.mrcoh@rediffmail.com	
10.	JULIUS. S	79/3, Salai Road Extn JK Towers, First Floor Thillai Nagar Trichy - 18.	7708007091 sjulius5@gmail.com	
11.	P. Tamilselvan	E.K. M-M & Sons 1-8, B.P. Agraharam Erode	8072442954 tannery.ekm@gmail.com	
12.	HARINI. V	62, Nehru Nagar, Kandipudur, Coimbatore	9487961189 harinivelumani1234@gmail.com	
13.	K. SATHIYAN	Coir Board Thanjavur	WP No 8754235201	
14.	M. Manivannan M. MANIVANNAN	SAAI COIRS Sengipatti.	WP NO 7373564613	
15.	K. Malkar Sayan	Dindigul Coir Producers Dindigul	9443036900 ferscoacoir@gmail.com	
16	V. Deepa.	9626896415 WP. No: 9524302435	South street Sengipatti Thanjavur (Dt)	

S. No	Name	Address	(Mobile No. & Email ID	Sign
17.	I. MSC MBT S. Lenin	9190/22/1 Vinayaga Nagar Pandalgudi	8778784907 lenin12206@gmail.com	
18.	I-MSC MBT HARINI. V	62, Nehru Nagar, Ondipudur, Coimbatore-641016	9487961185 hasthivelumani1224@gmail.com	
19.	I-MSC MBT E. Kayalvizhi	106-4th cross vasanthanagar 2nd Jayanagar Kannanagar Trichy-1	8903748581 kayalkayak039@gmail.com	E. Kayalvizhi
20.	I-MSC MBT A. Sivaranjani	1/486, Pookollai, Peravurani, Thanjavur.	7339474593 Sivaranjaniayyappan147@gmail.com	
21.	I-MSC MBT R. Dinesh kumar	SOUTH METTU STREET, VETTAIKARAN PUDUR. POLLACHI	8903413547 dinudk1273@gmail.com	
22.	I. M.SC MBT S. Sugan Joshi	11/54 Subramani, Parthipatti, Karur DK. Pincod: 621313	7868867222 sagayjoshi2000@gmail.com	
23.	R. Sivasakthivel	II MSC MBT	9080940254	
24.	Hariprasath. R	II M.Sc MBT	8148036915	
25.	Sowmitta. Dubey.	II M.Sc MBT	9433057308	S.D.

S. No	Name	Address	(Mobile No. & Email ID	Sign
26.	G. ANBALAGAN	SAAI COIRS Sengalattri	WP. NO: 8098819637	
27.	R. ASAITHAMBI	BHEL	9442649118	
28.	PRABHAKUMAR	Silove.	8762405535 prabuexports2090@gmail.com.	
29.	G. Poopalan Ro Coir Board	Ro, polla	Poopalang @gmail .com	8012594493
30.	Dr. S. Radhakrishnan CICT, Bengalura	Senior Scientific officer	9497442044 skharipad@gmail.com electronboard@gmail.com	
31.	K. Vinotha	DBT-Inspire Research Scholar, NFMC, BDU.	microvin095@gmail.com	
32.	S. Selvapriya	R/S, NFMC BDU	Priyaselvam1919@gmail.com	S. Priya
33.	V. Sangeetha.	JA, NFMC, BDU	sangeethav2006@gmail.com	
34.	Sureka. T.S.	JRF, R/S NFMC, BDU.	Surekats1996@gmail.com.	

S. No	Name	Address	(Mobile No. & Email ID	Sign
35	E. Kaviya	II MSC MBT	9486868629	
36	V Veeramurugan	" "	9626560206	
37	D. kartheeswaran	II M.Sc MBT	9655296963	
38	G. Sudha	II M SC MBT	8778358338	
39	Kumari Riya	"	8778018754	
40	Soniya Gupta	"	8240177440	
41	Gourav Chakraborty	"	8018631880	
42	S. Sai Mahesh Kumar	"	9790427858	
43	MAINAK ROY	II MSC, W.B	8240328217	

S. No	Name	Address	(Mobile No. & Email ID	Sign
44	Shrestha Dutta	II M.Sc. MBT	6295052412	Shrestha.
45	R-SARAN	II MSc MBT	6369413796	
46	M Subha Lakshmi	II MSC MBT	8940371411	
47	Arijit Talukder	II M.Sc M.B.T	9748832037 8017001917	Arijit Talukder
48	T.kumaravel	II MSc, Biotech National College	9442427393	T. kumo
49	S. KAVIYARASAN	JRF MBT	9944539263	S. Kavi
50	K.MAHESWARAN	II MSc Biotech NCT	7402633548	K. Mahe.
51	S. Yogarathan	II nd MSc II	9786993700	
52	R. Sanjuth	II M.Sc Biotech NCT	8012687138	

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Coir Board, (Ministry of MSME) Govt. of India
Alappuzha – 688 522, Kerala, India

One Day Training Programme on "Treatment of Tannery waste using Coir pith and effective microorganisms to convert it into organic manure

Feedback Form

S. No	Name & Address	Feedback	Sign
(1)	Venkatachalam Indeneed corprration Coimbatore 641030	Good one Please organize in little more systamatic way	
(2)	S. Thilagar Thilak Traders, Poovanam Pattukottai	Its an important unicreative pls Continue till it Succeed	
(3)	Rakkiyannam, C Grow Compost Srivani Entrels Santhanamangalam	Test Results with Units Please Share us the ppt mrakkiyannan@gmail.com	M.M
(4)	A. Sudha, 13/7K5, Palacode road, Karimangalam, Dharmapuri – 635111	Same attendee (5).	
(5)	I. John Kennedy, Kambar Street, Alangudy, Pudukottai	Good effort.	
(6)	Shameen Ahmed. KJ, Kajnadi Road,	Good effort keepen for convert waste kindly share the data/ ppt/analytis report to ath.tannery@think.com	

S. No	Name & Address	Feedback	Sign
(7)	Azhaluddin, 56, Periamaistry St, Periamet, Ch3	Took a sample. will review it Need Project Report	
(8)	M. Sivakumar, Shiva Coir Industry, 13/7K, Palacode Road, Karimangalam, Dharmapuri - TN	come out with more research.	
(9)	V. Riyaz Ahmed, KH Exports Industry Pvt. Ltd, P17, MBT Road, Ranipet.	Very informative. Share the PPT and Analysis Report of Before & After treatment of tanneries effluent. If Pos. tannery.mark@khindia.com	
(10)	P. Tamilselvan, E.K.H.M.J Sons, 1-8, B.P. Agraharam, Erode	Good Project for Tanneries and Agri Please Need full Project Report	
(11)	Julius-S, 7913, Salai Road Extn, JK. Towers, First floor Thillai Nagar, Trichy-18.	① Applicable TDS for Tannery waste, Pith & NRF, before After. ② project report like cost-wise	
(12)	Sathiyan. K, Coir Board, Thanjavur	Training is useful for making graphic mannum. for agriculture.	K. Sathiyan
(13)	M. Manivannan, SAAI COIRS, Sengipatti	Preparation is	Good.
(14)	K. Mallika Sayanti, Dindigul Coir associates, Dindigul	Very Good.	

S. No	Name & Address	Feedback	Sign
(15)	V. Deepa, South street, Sengipatti, Thanjavur.	நல்ல [illegible] கிடைத்தது.	V. Deepa
(16)	G. Anbalagan, SAAI COIRS, Sengipatti	The Experiens in good	
(17)	R. Asai Thambi, BHEL.	Useful workshop on manufacture of organic manure using coir pith, Tannery effluent and micro organism.	
18.	PRABHUKUMAR.R, Bangalor (CITI), PRABUEXPORTS. 8762640535	Good Session Expecting details of all available ~ prabuexports2090@gmail.com	
19.	P. Tamil Selvan, E.K. H.M & Sons, B.P. Agraharam Erode, 8072442954	—X—	—X—
20	A. Poorkala	Very informative and learn [illegible] coir pith is one of the [illegible] [illegible] for them	[illegible]
21.	P. SARAN.	Very good.	[illegible]
22.	S. Sai Mahesh	Initiative	[illegible]

S. No	Name & Address	Feedback	Sign
22.	Siva Sk Thivedi	Good	
24.	D. Karthikeyan	Excellent	
25.	R. Hariprasath	Good	
26	V. Veeramuruga	Good	V.V.
27	F. Raghu Kannan	Good	
28	Mainak Roy	Informative.	
29.	Arijit Talukdar	Good	
30	Gourav Chakraborthy	Excellent	

S. No	Name & Address	Feedback	Sign
31.	T. Kumaravel National college Trichy	Innovative, Excellent	T. kumaravel
32.	K. Maheswaran National College Trichy	useful workshop, and Innovative	K. Mally.
33	G. Sudhe II. M.Sc MBT	Informative	G. Sudhe
34.	M. Subha Lakshmi II M.Sc. MBT	very useful and get new information	M. Subha
35.	E. Kaviya II - M.Sc MBT	Good & useful program. Learned easily without staining	E. Kaviya
36.	Soniya Gupta II - msc - MBT	Good & Informative	
37.	Somdatta Dalushy II - Msc - MBT	Good & very informative.	S.D.
38.	Shrestha Dutta II - Msc MBT	Informative.	Dutta

S. No	Name & Address	Feedback	Sign
39.	Kumari Riya II Msc. MBT	Intell Got to know my Informative knowledge.	
40.	Souvik Nyaya II M.Sc. MBT	very much informative	
41.	HARINI. V I. MSC, MBT	Informative and knowledgeable	06/10/2021
42.	Kayalvizhi E. I. MSC, MBI	very informative and useful	Kayalvizhi E. 06/10/2021
43.	A Sivaranjani I M.S.C MBT	Very useful Informative	
44.	DINESH KUMAR. R Imsc MBT	Very Innovative. Preparation is good.	
45.	S. Lenin I MSC MBT	Effective & useful	
46	Sugan Joshi	Very Innovative and helpful	

DEPARTMENT OF MARINE BIOTECHNOLOGY
BHARATHIDASAN UNIVERSITY
Tiruchirappalli – 620 024, Tamil Nadu, India
&
CENTRAL COIR RESEARCH INSTITUTE
Coir Board, (Ministry of MSME) Govt. of India
Alappuzha – 688 522, Kerala, India

CERTIFICATE OF PARTICIPATION

This is to certify that _____has participated in One Day Training programme on "Treatment of Tannery waste using Coir pith and effective microorganisms to convert it into organic manure" on 6th October, 2021.

Dr. P. MALLIGA
Organizer

DEPARTMENT OF MARINE BIOTECHNOLOGY
BHARATHIDASAN UNIVERSITY
Tiruchirappalli – 620 024, Tamil Nadu, India
&
CENTRAL COIR RESEARCH INSTITUTE
COIR BOARD
Alappuzha - 688 522, Kerala, India

We cordially invite you for the discussion on

Project: Development of Research and Training for Tannery waste treatment using coir pith and effective micro organisms to convert it into organic manure

by

The Hon'ble Chairman
National Coir Board,
Ministry of MSME,
Cochin, Gov. of India

The Hon'ble Vice Chancellor
Bharathidasan University,
Tiruchirappalli-24,
Tamil Nadu, India

Visit on 11.10.2021 (Monday) at 10.30am (VC Office, NFMC & MOF)

Dr. P. MALLIGA
Professor & Principal Investigator
Dept. of Marine Biotechnology,
Bharathidasan University,
Tiruchirappalli-24

The Registrar
Bharathidasan University,
Tiruchirappalli-24,
Tamil Nadu, India

DEPARTMENT OF MARINE BIOTECHNOLOGY
BHARATHIDASAN UNIVERSITY
Tiruchirappalli – 620 024, Tamil Nadu, India
&
CENTRAL COIR RESEARCH INSTITUTE
Coir Board, (Ministry of MSME) Govt. of India
Alappuzha – 688 522, Kerala, India

The Hon'ble Chairman visit to Hon'ble Vice Chancellor Bharathidasan University

The Hon'ble chairman of National Coir Board, Ministry of MSME, Cochin, Government of India visited Department of Marine Biotechnology, Bharathidasan University, Tiruchirappalli on 11.10.2021 (Monday) and discussed with the Hon'ble Vice Chancellor, Bharathidasan University about the Treatment of tannery waste using coir pith and effective microorganisms to convert it into organic manure and training programme conducted at Model Organic farm.

Dr. P. Malliga, Professor, Department of Marine Biotechnology, Bharathidasan University narrated the organic manure production at National Facility for Marine Cyanobacteria (NFMC) and exhibited the decomposed manure in Model Organic Farm (MOF) to the Hon'ble Chairman, Coir Board, G. Poopalan, Regional officer, Coir Board Pollachi and other Industry representatives.


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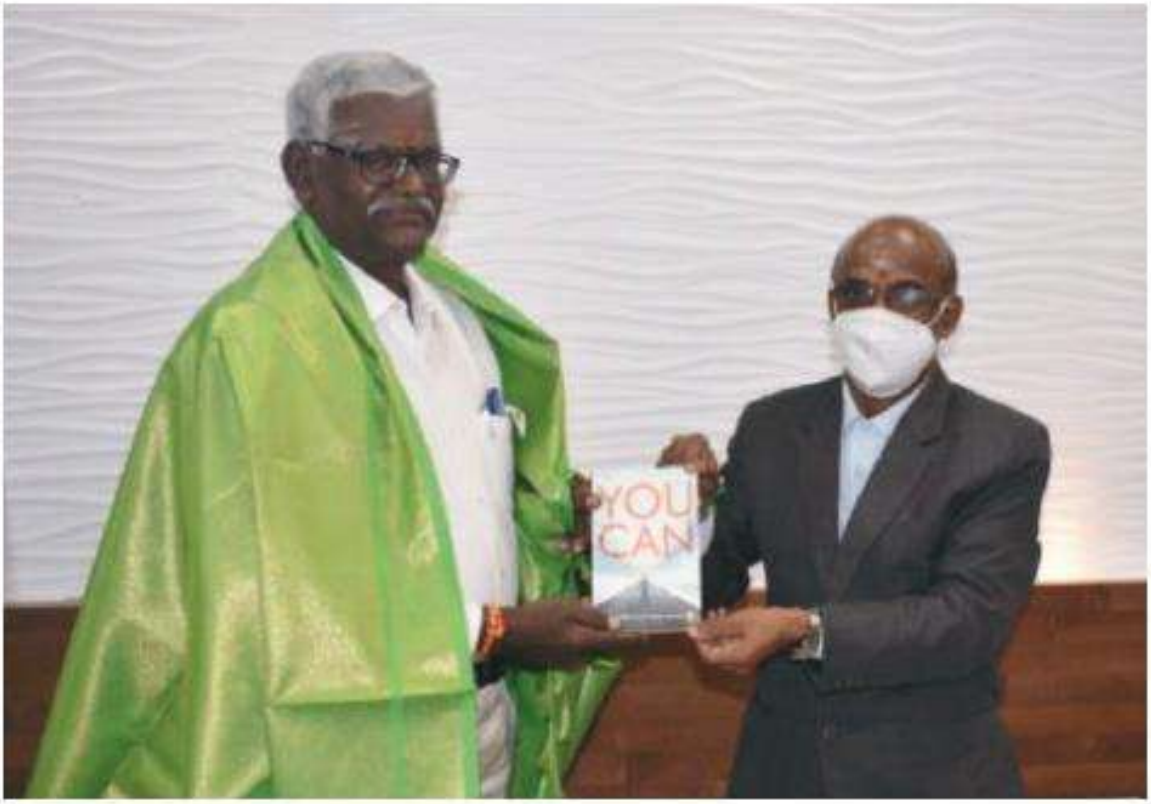

The Union Ministry of Small Industries' Coir Industries Board Chairman T.Kuppuramu after visiting the Department of Marine Bioitechnology and met Vice-Chancellor of Bharathidasan University M.Selvam and suggested to start producing organic fertilisers by using the coir particles and effective microbiologists and also using the effluent derived from the tanning of skins. Professor of Marine Biotechnology Department P.Mallika was present during the discussion.