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Standardization of Suitable Vermiculture technology for the Remediation of Alcohol Based Distillery Effluent Polluted Agricultural Soil

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ABSTRACTS

Untreated effluent from the alcohol based distillery factory contaminates a vast agricultural land near Chittoor town Andhra Pradesh. Since distillery effluents are known to contain organic and plant nutrients. It can be used for agriculture and aquaculture after proper treatment. In the present study, an effort has been made on the remediation of distillery polluted agricultural soil collected from Rajiv Gandhi Nagar town, which involved culture of two earthworm species Lampito mauritti (endemic) and Eudrilus euginiae(exotic)and with additional base organic substrates such as cow dung+vegetable refuse + Green leaves (Org.Sub-1) pressmud (Org.sub-2)based on the vermicompost analysis a suitable vermiculture has been standardized for the remediation of distillery effluent polluted agricultural soil.

Keywords: *Lampito mauritti; Eudrilus euginiae;* distillery factory; vermicompost

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INTRODUCTION

The vermicompost is a valuable product when used as a soil conditioner. It is a source of micro and macro elements in addition to many important biochemical which are required for the growth of plant. Earthworm have beneficial effect on soil structure and fertilizer increase pasture and crop production and reduce the soil degradation[1-4].
Though the preparation of vermicompost using earthworm is an ancient practice, it has gain popularity in the recent years due to the demand for products cultivated using organic farming. In addition to the production of vermicompost the technology also help in solving problem of waste disposal organic pollution, soil sickness and expenditure on import of chemical fertilizer it helps sustainable agriculture [5] release of plant nutrient [6] and balanced soil health [3, 7].

Safe disposal of industrial waste water has become a challenge for industrial managers and for scientist also. Rapidly increasing industrialization and urbanization have resulted into the generated of huge qualities of waste water. Use of untreated industrial waste water for crop irrigation is a common practice by the formers. The effluent enhanced the NPK values and crop yield considerably [8]. The waste water application increases the cart. Organic carbon is beneficial for crops as it increases the uptake of NPK and Ca, mg and Sulphur. These nutrients can be used for plant growth after proper treatment. Environment of soil carbon in soil due to addition of industrial waste water has been reported [9]. The cattle dung vegetable refuse pressmud and organic substrates can be added to increase the nutrient in the soil for better agricultural input.

MATERIALS AND METHODS

The African species *Eudrilus euginiae* were collected from the Agricultural University Bangalore and the *Lambito mauritti* were collected from local agricultural soil and cultured in the laboratory as per the method described by Ismail, [10]. The mature worm was used for experimental purpose.

Top soil from1-10 cm depth and sub soil from 32-35 cm depth were collected from polluted and unpolluted agricultural area. The polluted area represents the distillery polluted agricultural land of Rajiv Gandhi Nagar, Chittoor, Andhrapradesh India and unpolluted land represent the control soil of Kaniyambadi Village Vellore district Tamil Nadu India.

The physic chemical parameter of control and distillery polluted soil vermibed mixture initial and vermicompost final are analysed. The potable tap water was used for control and experiment. The analysis of physico chemical parameter such as pH, EC (Electrical Conductivity) Moisture, Porosity, Specific gravity Calcium Magnesium Nitrogen, Phosphorus and Potassium (NPK) were carried out as per the method of Jackson, [11].

Different kind of processed organic substrate were used as an additional nutritional source for earthworms such as cowdung +Vegetable refuse +Green leaves)(Org.Sub.1) and pressmud is a waste of sugar factory (Org.Sub.2). the vermibed were prepared in crates (size: 60cmX30cmX30cm) as per the method described by Ismail, [10]. 10 number of Earthworm Eudrilus euginiae and Lampito mauritti were introduced in the each experimental trough with six replicates. Once in a week the bed was carefully mixed without any disturbing worms until the exposure periods of 60 days

RESULTS AND DISCUSSION

Both the earthworm species *Eudrilus euginiae* (epigeic) and *Lampito mauritti* (anecic)can be used together in vermicomposting since epigeic species are surface dwellers which live organic harizons and ingest large amount of decomposed litter and anecic earthworm like Lampito mauritti are predominantly bottom dwellers responsible for vertical burrows and leave casting in and above the surface [10]. Hence in the present investigation *Eudrilus euginiae* (epigeic) and *Lampito mauritti* were used together remediating the distillery polluted agricultural soil with two different organic substrates like cowdung+vegetable refuse+green leaves Org.Sub.1and pressmud Org.Sub.2 were used separately, simultaneously both Org.Sub.1&2 . Table-1 is represent the physic chemical characters in vermimixture intial and vermicompost final of *Lampito mauritti* and *Eudrilus euginiae* exposed to control and distillery polluted agricultural soil (experimental) treated with Org.Sub.1(Cowdung+Vegetable refuse+Green leaves) and Table-2 shows physic chemical characters in vermimixture intial and vermicompost final of Lampito mauritti and Eudrilus euginiae exposed to control and distillery polluted agricultural soil (experimental) treated with Org.Sub.2. Table-3 display characters in vermimixture intial and vermicompost final of *Lampito mauritti* and *Eudrilus euginiae* exposed to control and distillery polluted agricultural soil (experimental) treated with Org.Sub.1(Cowdung+Vegetable refuse+Green leaves) and Org.Sub.2.

Table – 1: PHYSICO-CHEMICAL CHARACTERS IN VERMIMITURE (INITIAL)AND VERMICOMPOST (FINAL)OF (LAMPITO MAURITII AND EUDRILUS EUGINIAE) EXPOSED TO CONTROL SOIL AND DISTILLERY POLLUTED AGRICULTURAL SOIL (EXPERIMENTAL) TREATED WITH ORG.SUB.1(COWDUNG+VEGETABLE REFUSE+ GREEN LEAVES).

Parameter	Control		Experimental	
	Initial	Final	Initial	Final
pH	7.98±0.47	7.58±0.02	6.77±0.04	7.29±0.01
EC(µmhos/m^2)	0.74±0.01	1.84±0.01	1.62±0.02	2.80±0.19
Specific Gravity gm/cc	4.34±0.05	8.37±0.05	3.33±0.05	9.63±0.08
Porosity%	28.58±0.03	45.73±0.04	20.34±0.06	59.36±0.20
Moisture%	2.54±0.01	5.53±0.02	2.37±0.01	6.78±0.08
Nitrogen%	0.04±0.06	0.82±0.10	0.07±0.007	0.92±0.01
Phosphorous%	0.25±0.01	0.46±0.01	0.42±0.04	0.71±0.01
Potassium%	0.56±2.04	2.04±0.01	1.26±0.01	3.00±0.08
Calcium%	0.88±0.02	4.45±0.05	1.36±0.01	6.56±0.07
Magnesium%	1.48±0.02	3.25±0.01	1.87±0.24	4.03±0.05

Values are expressed in mean ±SE of six individual values

Table – 2: PHYSICO-CHEMICAL CHARACTERS IN VERMIMITURE (INITIAL)AND VERMICOMPOST (FINAL)OF (LAMPITO MAURITII AND EUDRILUS EUGINIAE) EXPOSED TO CONTROL SOIL AND DISTILLERY POLLUTED AGRICULTURAL SOIL (EXPERIMENTAL) TREATED WITH ORG.SUB.2.PRESSMUD

Parameter	Control		Experimental	
	Initial	Final	Initial	Final
pH	7.90±0.06	7.35±0.01	5.63±0.04	7.22±0.02
EC(µmhos/m^2)	0.84±0.01	1.77±0.02	1.59±0.07	2.46±0.12
Specific Gravity gm/cc	4.40±0.10	8.56±0.11	0.06±0.05	0.86±0.02
Porosity%	28.52±0.11	43.41±0.08	20.33±0.05	54.52±0.12
Moisture%	2.39±0.08	5.38±0.06	2.17±0.01	6.74±0.04
Nitrogen%	0.04±0.08	0.04±0.02	0.37±0.01	0.54±0.01
Phosphorous%	0.26±0.01	0.35±0.01	1.12±0.04	0.30±0.02
Potassium%	0.45±0.01	1.46±0.07	1.26±0.09	5.30±0.04
Calcium%	0.80±0.02	4.63±0.12	1.77±0.02	3.76±0.01
Magnesium%	1.48±0.20	3.11±0.02	1.86±0.02	4.02±0.05

Values are expressed in mean ± SE of six individual values

Table – 3: PHYSICO-CHEMICAL CHARACTERS IN VERMIMITURE (INITIAL)AND VERMICOMPOST (FINAL)OF (LAMPITO MAURITII AND EUDRILUS EUGINIAE) EXPOSED TO CONTROL SOIL AND DISTILLERY POLLUTED AGRICULTURAL SOIL (EXPERIMENTAL) TREATED WITH ORG.SUB.1(COWDUNG+VEGETABLE REFUSE+ GREEN LEAVES)AND PRESSMUD.

Parameter	Control		Experimental	
	Initial	Final	Initial	Final
pH	7.85±0.06	7.20±0.01	5.77±0.04	7.32±0.01
EC(µmhos/m^2)	0.83±0.01	1.79±0.02	1.63±0.02	2.85±0.19
Specific Gravity gm/cc	4.43±0.10	8.59±0.11	3.35±0.05	9.68±0.08
Porosity%	28.52±0.11	45.42±0.08	21.34±0.06	59.37±0.20
Moisture%	2.40±0.08	5.42±0.06	2.38±0.01	6.79±0.08
Nitrogen%	0.04±0.08	0.46±0.02	0.07±0.07	0.98±0.01
Phosphorous%	0.27±0.01	0.38±0.01	0.42±0.04	0.72±0.01
Potassium%	0.47±0.01	0.48±0.07	1.28±0.01	3.12±0.18
Calcium%	0.81±0.02	4.65±0.12	1.38±0.01	6.58±0.07
Magnesium%	1.48±0.20	3.15±0.02	1.88±0.02	4.05±0.05

Values are expressed in mean ± SE of six individual values

The physico chemical factors were also significantly changed from initial (vermimixture) to final (vermicompost)with regard to pH, EC(Electrical Conductivity)specific gravity, moisture, NPK(Nitrogen, Phosphorous, Potassium), calcium(ca), magnesium(mg). The increase in Electrical conductivity (EC) indicates that the vermicomposting improves the availability of soluble minerals in the soil [12] the increase of in the porosity and real specific gravity brought out by the feeding activities of the earthworm. The increase in nitrogen, phosphorous, potassium Ca, and Mg makes the organic materials suitable for use of manure for the cultivation of crops.

CONCLUSION

The earthworm species *Eudrilus euginiae* (epigeic)surface dwellers decomposed the organic substrate in the upper layer and made the nutrient available for the bottom dewllers *Lampito mauritti* (anecic) cosuming the these nutrients was able to neutralize the polluted soil. Thus the combination of both organic substrates such as cowdung mixture and press mud with both the earthworm species *Eudrilus euginiae* (epigeic) and *Lampito mauritti* (anecic)was able to detoxify (remediate) the distillery polluted soil restored.

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