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Reclamation of Dye Affected Soil at Tirupur Region by Using Vermitechnology, South India

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Keywords

Dye affected soil
Fungal population
Vermicompost
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Abstract

Soil from the dye affected area is taken for various analysis. Similarly soil from the fertile land is also taken for analysis in the same region. Most of the soils polluted by heavy metals can be reclaimed using a number of expensive tactics that either remove the contaminants or stabilize them within the soil .To analyze the parameters such as soil pH, temperature, soil fungal, bacterial and actinomycetes population of both the samples. Find out what are the metals present in the soil samples. Apply vermicompost to the dye affected soil for reclamation. Again we should analyze soil pH, temperature, fungal, bacterial and actinomycetes population of both the soil samples .The results are discussed with the literature.

1. Introduction

All natural soils contain vast populations of microscopic plants and animals present in a state of dynamic equilibrium and changing balances. It has been estimated that within the top one to three feet of soil as much as 17,000 lbs. fungi and 40 lbs. bacteria exist per acre. All the soil microorganisms compete with each other for food and space. Any change in environmental conditions such as food supply, nutrient without adequate treatment. The discharge of effluents has caused severe pollution on both the surface and ground water in the region and has also contaminated agricultural land. The disposal of untreated wastewater on land and the Noyyal River has affected the quality of surface water, ground water and the soil not only in Tirupur but in downstream. Available studies clearly prove that, the accumulation effect of pollution in and around Tirupur and the downstream stretch of Noyyal exhibit high level temperature, moisture, oxygen supply, etc., can result in changes which cause one or many types of soil microbes to become temporarily dominant over the others. Raicevic et al.(2005) reported that The contamination of soils due to the presence of toxic metals can result in serious negative consequences, such as damage of ecosystems and of agricultural productivity, deterioration of food chain, contamination of water resources, economic damage and, finally, serious human and animal health problems

The majority of fungi and bacteria present in soils are considered to be beneficial to higher plants by direct association with roots (mycorrhizae, nodule forming bacteria), breakdown and release of minerals from organic matter present in the soil resulting in essential element availability increases to higher plants, parasitizing harmful or disease causing microorganisms or suppressing growth, reproduction or activity of harmful disease causing microorganisms through other interactions such as chemical inhibition.

Disease-host interaction is dependent upon environmental conditions. Any "stressful" environmental condition which favors the proliferation and activity of harmful parasitic microorganisms; but inhibits, harms, or otherwise stresses higher plants, will normally result in the disease-host complex establishment.

Tirupur is a fast growing industrial district in Tamilnadu, also known as the 'Banian City' of India. It is located on the bank of the Noyyal River, a tributary of the River Cauvery. The hosiery industry in Tirupur provides substantial contribution to the economy in the form of income, employment and foreign exchange generation (Geetha et al., 2008). However, the rapid growth of the industry has resulted in serious environmental problems, especially from the bleaching and dyeing units. Hence there is evidence to suggest that these units extract considerable quantity of ground water from the peripheral areas and discharge the effluents of TDS and various salts due to industrial pollution. Environmental pollution is an 'externality' in welfare economics. An externality is present .Whenever individual's utility and production relationships include real (i.e. non -monetary) variables, whose values are chosen by others (persons, corporations, governments) without particular attention to the effects on welfare (Xia Guang, 2000). Marchiol et al.(2004) reported that the ability of certain plants to accumulate excess amounts of heavy metals in their

tissues has been of interest to geobotanists and physiologists for many years.

In the preliminary study to reveals that measurement of pH and microbial population under application of vermicompost in the dye affected soil selected from the Tirpur region.

2. Materials and Methods

Sampling stations

The soil samples were collected from Vallipalayam region, Tirupur Taluk, particularly selected for this present investigation. Most of the dye industries are being developed day by day in this region and also to pollute the soil and water in and around the Tirupur environment. That is why we have selected the sampling stations from this region.

Sample collection time

The soil samples were colleted at morning time. The samples collected during the month of August 2009 for to determine the different parameters of the soils.

Location of the sampling site

Tirupur is recently formed District by Government of Tamilnadu. Its surrounded by Coimbatore, Dindigul , Karur and Erode District. The Latitude and longitude of Tirupur is 11° 6' 0" N / 77° 21' 0" E. Most of the textile industries is located at this region.

Soil maintenance

Soils were maintained in beakers closed with a sterilized cotton plug wrapped in gauze to allow air exchange. The soil moisture was kept constant during the entire period of the experiments by periodically weighing and replacing any losses with sterile water. Samples were incubated at 20 ± 0.5°C in the dark. Solutions and instruments were sterilized and all steps were performed in a sterile cabinet (Grenni et al., 2009).

Vermicompost collection

The vermicompost was purchased from Selvam Verimicompost Unit, Modakuruchi, Erode District for mixed with soils thein the form of recommended dose and evaluate the designed experiments.

Measurement of pH from the soil

Soil pH measured by the following the method of Subbaiah and Asija (1959)

Analysis of bacterial population

Bacteria: Soil extract agar (Allen, 1953)

Glucose	:	1.0 g
Dipotassium hydrogen phosphate	:	0.5 g
Agar	:	15.0 g
*Soil extract	:	100 ml
Distilled water	:	900 ml
pH	:	7.0-7.2

*Soil extract was prepared by treating 1000 g of soil with 1000 ml of tap water in an autoclave at 15 lbs pressure for 15 minutes. A small amount of calcium carbonate was added and the soil suspension was filtered till the extract was clear.

Fungi: Martin's Rose Bengal Agar (Martin, 1950)

Dextrose	:	10.0 g
Peptone	:	5.0 g
Potassium dihydrogen phosphate	:	1.0 g
Magnesium sulphate	:	0.5 g
Rose Bengal	:	1.0 part in 30,000 parts
Agar	:	20.0 g
Distilled water	:	1000 ml
pH	:	6.8-7.2

Germination study

For evaluation of soil fertility to determine the germination by using *Vigna mungo* (L) Wilczek selected for the present study.

3. Results

Table. 1. Measurement of pH at various soil types in Tirupur region

Different soil	pH
Dye affected	6.3 ± 1.02
Fertile soil	7.5 ± 1.15
Vermicompost	7.2 ± 0.75
Vermicompost and Dye affected soil	6.7 ± 0.85
Vermicompost and fertile soil	7.6 ± 1.23

Table.2. Soil Bacterial population

Different soil	(Bacteria x $10^{-5}g^{-1}$ Soil)
Dye affected	1.23 ± 2.30
Fertile soil	2.45 ± 1.23
Vermicompost	8.64 ± 1.11
Vermicompost and Dye affected soil	5.42 ± 1.02
Vermicompost and fertile soil	9.65 ± 1.09

Table.3. Soil fungal population

Different soil	(Fungi x $10^{-5}g^{-1}$ Soil)
Dye affected	2.25±1.32
Fertile soil	5.63 ±0.58
Vermicompost	8.63 ±1.14
Vermicompost and Dye affected soil	4.63 ±1.89
Vermicompost and fertile soil	9.74 ±1.63

Table.4. *Vigna mungo* germination percentage at different soil medium

Different soil	(%)
Dye affected	08 ± 1.03
Fertile soil	58 ± 1.23
Vermicompost	85 ± 1.32
Vermicompost and Dye affected soil	55 ± 1.54
Vermicompost and fertile soil	90 ± 1.36

In the Results shows that ,pH improves when the addition of vermicompost (Table.1).The microbial population such as bacteria and fungi shows that better performance after the addition of vermicompost in dye affected soil(Table 3 & 4 and Figure 1 & 2). Fertile soil normally having the fungal population and soil characters are reflect good when compared to dye affected soil. We have observed the germination percentage in different soils such as dye affected soil, fertile soil, vermicompost, vermicompost with dye affected soil and vermicompost with fertile soil. Here, the dye affected soil improves the germination 58.75 percentage after the addition of vermicompost (Table 4, Figure 3).

Fig.1a. Bacterial population studies by using dye affected soil medium

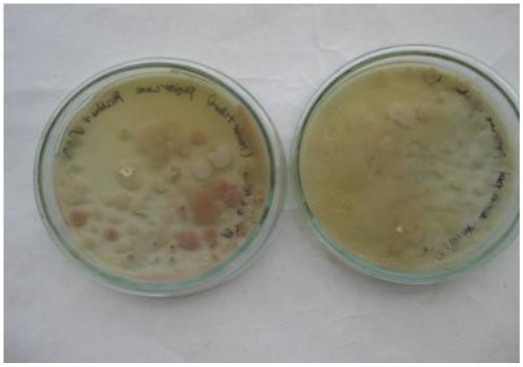

Fig.1b. Bacterial population studies by using fertile soil medium

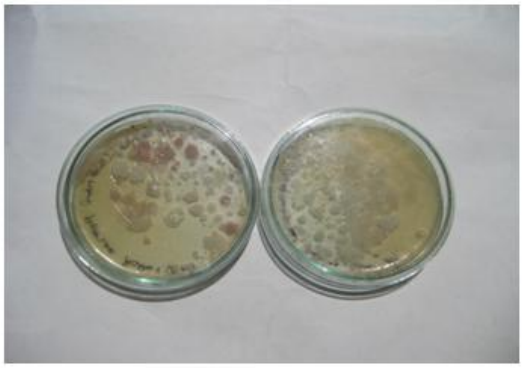

Fig.1c. Bacterial population studies by using vermicompost medium

Fig.1d. Bacterial population by using mixture of vermicompost and dye affected soil medium

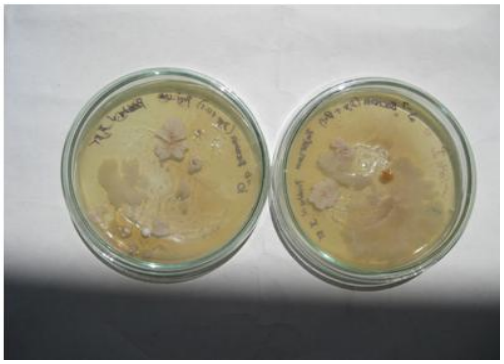

Fig.1e. Bacterial population studies by using vermicompost and fertile soil medium.

Fig.2a.Fungal population studies by using dye affected soil medium

Fig.2b. Fungal population studies by using fertile soil medium

Fig.2c. Fungal population studies by using vermicompost medium

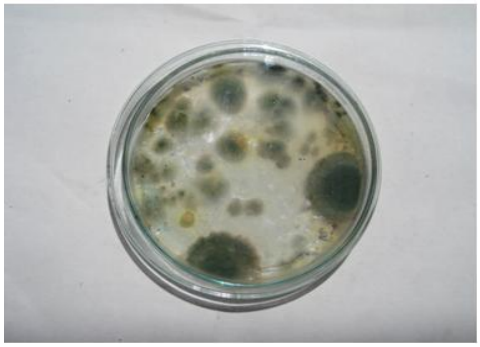

Fig.2d. Fungal population by using mixture of vermicompost and dye affected soil medium

Fig.2e. Fungal population studies by using vermicompost and fertile soil medium

Fig.3a.Germination studies by using dye affected soil medium

Fig.3b.Germination studies by using fertile soil medium

Fig.3c.Germination studies by using vermicompost medium

Fig.3d.Germination studies by using mixture of vermicompost and dye affected soil medium

Fig.3e. Germination studies by using vermicompost and fertile soil medium

4. Discussion

In Europe, a number of agri-environment schemes (AES) have been introduced which subsidise farmers to 'deliver effective environmental management on their land' (Wardle, 1995). While the specific aims of the individual schemes vary, a primary objective common to most is the conservation of biodiversity (Yamashita and Takeda, 1998), with the goal not only to increase the value of farmland for wildlife, but also to restore natural ecosystem functioning. This study aims to examine the impact of an agri-environment scheme prescription on ecosystem functioning by testing the hypothesis that decom-position rates in arable field margins are influenced by vegetation management. These processes increase the leaching of soluble compounds, and stimulate microbial activity by translocating propagules and inoculating new substrates (Seastedt, 1984; Wolters, 1991). Soil-feeders such as endogenic earthworms feed on soil organic matter and are able to live in soils with as little as 1% organic matter due to efficient breakdown of organic compounds inside their gut by endosymbiotic microflora (SAS, 2002). decomposition, and may contribute directly to mineralisation, and may contribute directly to mineralization processes, as well as modifying soil porosity and structure in the upper soil layers as they move to exploit new resources (Smallshire and Cooke,1999). The results of the microbiological analysis indicated that Dye affected soil did not affect the activity of bacterial populations (interms of viable cell number and therefore did not have any toxic effect on these functions, presumably because they were adapted to its presence. On the contrary, the presence of vermicopmost had a positive effect on it, as shown by the significant increase of soil microbial population of soils. The stimulation of microbial activity by the carbon readily bio available from organic amendments, has been found by other authors (Felsot and Dzantor, 1995; Moorman et al., 2001). The "driven force" in the soil microbial community studied was therefore the organic matter and its quality and in fact bacterial community activity was favored.

5. Conclusion

Mineral soils represent a complex of inert materials and living organisms. By maintaining good organic matter content in mineral soils , an increased population level of beneficial soil microorganisms can be maintained. Vermicompost is better for reclamation of dye affected soil and also improve the microbial population in the agricultural soil. This will be very useful to prevent the contamination of soil continuously. We recommend to the farmers in and around Tirupur region villages to reduce the soil pollution by dye.

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