AN EXPERIMENTAL STUDY OF EFFLUENTS FROM TEXTILE INDUSTRY & ITS EFFECTS ON SOIL QUALITY IN TIRUPUR AREA

Mrs. Saraswathy S[1], Sakthiudhayakumari S[2], Jesina P M[2], Rohini M[2], Anbusethupathi K[2]

[1] *Asst.Professor, Department of Civil Engineering, VSB College of Engineering Technical Campus, Coimbatore .*
[2]*Student, Department of Civil Engineering, VSB College of Engineering Technical Campus, Coimbatore.*

Abstract – Soil is the most important constituent for the fulfillment of all the basics needs of human beings. Soil is a mixture of organic matter, minerals, gases, liquids, and organisms that together support life. Due to rapid industrialization and urbanization the soil quality is getting affected. A fast growing industry is the textile industry. Development of textile industry and the disposal of effluents into the main cause for degradation of soil. The textile effluents contains impurities like alkalies, residual dies, starches cellulose, soluble salts mainly sodium and calcium, silicate, oil and other impurities. The chemicals affect the farming area near to the depositions site. In this project we are testing and analyzing the, Nutrients required for plant growth, Physico-chemical properties of the degraded soil collected from various distances from the deposition site in Tirupur area and have analyzed whether there is possibility of increasing plant growth in the degraded soil collected in the site by applying natural manures, reducing concentration of chemical level etc.,

Keywords: Soil, Textile effluents, Physico-Chemical, Nutrients, Natural manure

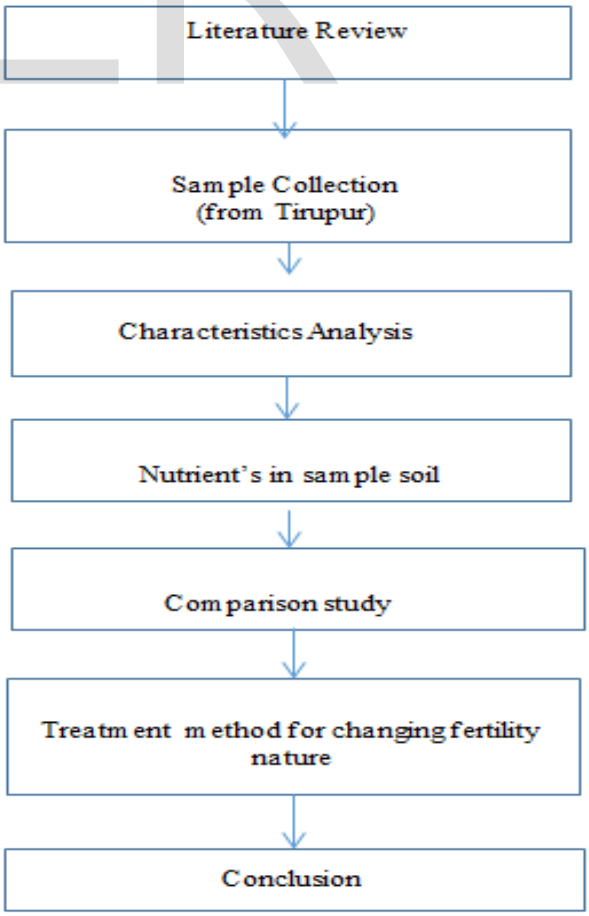
1. INTRODUCTION

Clothing is one of the most basic need for human beings. In olden days people used to wear clothes to protect themselves from extreme climatic conditions but now in the world of fashion a person's appearance, dressing and clothing judges a lot. Nowadays material business is one of the largest division of India and natural of material plant's squanders is genuinely reported (Patel and shrivastava,1999).Textile industries generate pollutants during the processing of cloth, which consists of scouring, bleaching, mercerizing, dyeing, printing and finishing operations. Such processing operation involves use of a large number of chemical including acids, alkalies, oil detergents, dyes etc., (Mathur and Bhatnagar, 2003). During ancient times dyes from natural resources like tesu flowers were used for brightness and color. Due to the biodegradability of these dyes they are nonhazardous. But they are expensive of cheaper and easily available chemicals. These chemicals which are discharged into the soil by effluents may retain for years and the effects may be felt over a long period of time (Deka and Bhattacharyya, 2007). In the present study, an attempt has been made to assess the impact of textile industries on the soil quality of Tirupur industrial area, and by monitoring various Physico-Chemical parameters of contaminated soil and analyzing the nutrients present in it for required plant growth, and suggest the low cost treatment method.

2. STUDY AREA

Tirupur is located at 11.1075°N 77.3398°E on the banks of Noyyal river. Our selected site is located near the bank of Noyyal river. It has an average elevation of 295 meters and covers an area of 159.6 km^2 . It has around 500 textile manufacturing companies. The Noyyal is one of the sacred river in Tamil history. In past years water was used for drinking and other agricultural activities without filtering. After that textile industries are releasing waste and disposal into this river. Due to this the nature of water get changed in its both Physico-Chemical characteristics and Nutrients contents in soil. The sample is collected from 3 places from the most polluted area, 300 meter distance, 600 meter distance.

3. METHODOLOGY



3.PHYSICO-CHEMICAL CHARACTERISTICS

3.1 pH

pH is the significant property of soil. It is the measure of alkalinity or acidity of soil. The ranges less than 6 is acidity soil. The range between 6 to 8.5 is neutral soil. The range above 8.5 is alkalinity soil. For optimum plant growth required pH range is 5.5 to 7 pH. If pH is below 6, Some nutrients such as nitrogen, phosphorous and potassium are less available. When pH exceed 7.5 iron, manganese and phosphorous are less available. A productivity growth slightly acidic to neutral soil.

3.2 TEMPERATURE

Soil temperature depends on the ratio of the energy absorbed to that lost soil temperature range between 20°C to 60°C. The temperature of the soil is the important property because it shows its effect on the chemical, physical and biological process related to growth of plant and germination of seeds.

Figure 1: Thermometer

3.3 ELECTRICAL CONDUCTIVITY

Electrical conductivity is the measure of the amount of salts presents in soil. It is the important indicator of soil growth. And electrical conductivity also important factor for indicating the Nitrogen present in soil.

3.4 COLOR

The color of soil has less effect on plant growth but it indirectly indicates the soil properties. Color is the indicator of Organic matter content, drainage and aeration. Different color of the soil indicate the various properties of soil.

Figure 2: Contaminated soil

3.5 TURBIDITY

Turbidity of soil is developed due to presence of salt, clay, organic matter and microscopic plants and animals suspended or floating in the water. Due to high turbidity Soil will not allow sunlight enter in to it and also limit the photosynthesis.

3.6 MOISTURE CONTENT

The soil moisture content of soil is the quantity of water it contains. Water content is used in the wide range of scientific and technical areas. Soil water serves as a solvent and carries of food nutrients for plant growth. If the moisture content of soil is optimum for plant growth, plants can readily absorb soil water. Much of water remains in the soil as thin film. Soil water dissolves salt and makes up to the soil solution, which is important as medium for supply of nutrients to growing plants.

Figure 3: Soil sample and Dry oven

Table 1: Physico-chemical characteristics of soil

Characteristics	Contaminated oil sample			Field soil
	Sample 1	Sample 2	Sample 3	
pH	7.99	8.15	7.68	6.75
Temperature (°C)	19	18.5	20.9	25
Specific Gravity (gms)	0.762	0.79	0.67	0.768
Colour	Greenish black	Dark brown	Dark black	Dark brown
Organic Carbon (%)	0.51	0.60	0.53	0.72
Moisture Content (%)	5.64	9.02	8.5	7.35
Electrical conductivity (µs/ms)	1.123	0.470	1.132	0.172

4.MACRO AND MICRO NUTRIENTS

4.1 MACRO NUTRIENTS

In plant nutrients, it is important that there is no deficiency in primary and secondary macro elements or in essential microelements. moreover these elements should be in proper proportions. Each of the nutrients have individual role in plants growth.

4.1.1 NITROGEN

Nitrogen occurs in several forms: Nitrate and nitrite anions, ammonium. If the soil Nitrogen content is low, the application of N fertilizers becomes indispensible1, Adequate supply of this element is associated with the plant growth and the deep green plant color. The excess of this element can delay the crop maturity and prolong the growth period5. The soil which is deficient in Nitrogen has stunted plant growth and they show signs of *chlorosis.* There should be a proper quantity and proportion of soluble N which can be absorbed by the crop.

4.1.2 POTASSIUM

Potassium is associated with the guideline of water and the vehicle of the plant's hold substances. It expands photosynthesis limit, fortifies cell tissue, and actuates the retention of nitrates. If potassium get increased If potassium get decreased brings about an absence of parity among different supplements, for example, calcium, magnesium, and nitrogen. When there is a potassium inadequacy, dull spots show up on the leaves.

4.1.3 CALCIUM

It is present in the soil either as soluble Ca_2 on the base complex or as free Calcium carbonate ($CaCO_3$). Intemperate soil it is present in abundance but it is absent in highly weathered tropical soils. It has a double role in the fertility of soil. It acts as plant nutrient at the same level as N, P and Mg as well as a pH regulator.

4.1.4 PHOSPHOROUS

Phosphorus is engaged with root development, which it invigorates. In the airborne zone it favors blooming. In spite of the fact that phosphorus is likewise vital during the plant's development time frame, it is significantly more associated with the blooming stage. Phosphorus is engaged with moving and putting away vitality. It improves the plant's general state and builds the orus is fundamental in natural compound development and the right execution of photosynthesis. A lack of phosphorous outcomes in a late, insufficient blooming, cooking and wrinkling of the leaves, and an absence of power as a rule.

4.1.5 MAGNESIUM

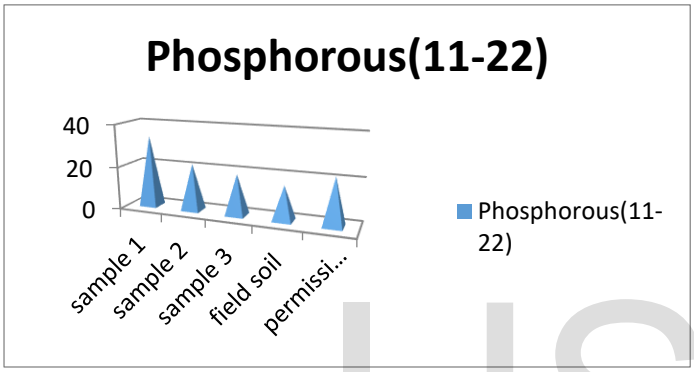
Magnesium constitutes the core of the chlorophyll molecule and is therefore essential for photosynthesis. This makes it an indispensable element for plant development. Magnesium promotes the absorption and transportation of phosphorus. It contributes to the storage of sugars within the plant. Magnesium performs the function of an enzyme activator, and in fact activates more enzymes than any other nutrient. Magnesium deficiencies result in weak stalks, loss of greenness in the oldest leaves, and the appearance of yellow and brown spots, even though the leaves' veins remain green.

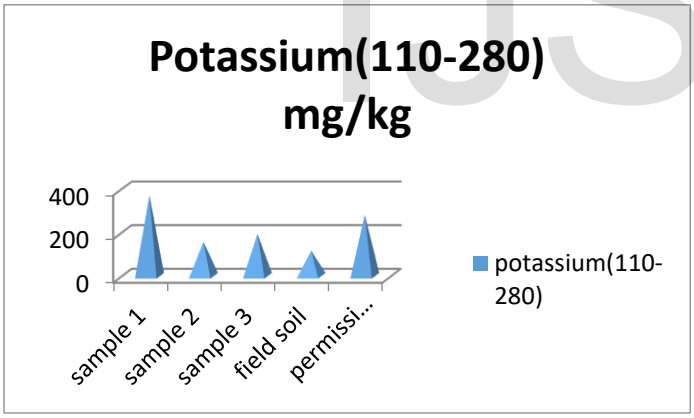
4.1.6 SULPHUR

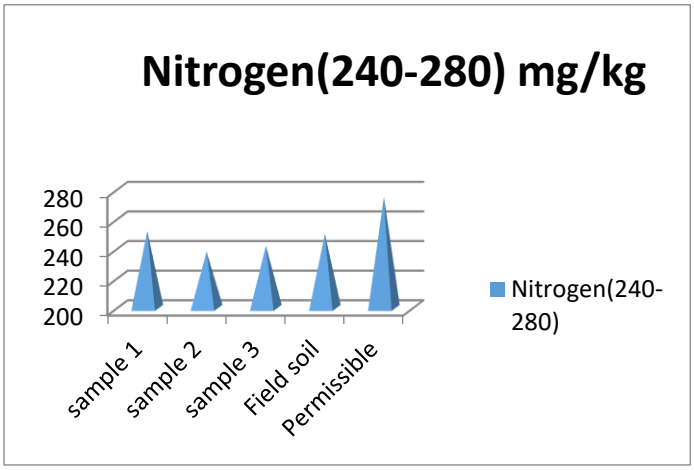
Sulfur participates in the formation of chlorophyll. It is necessary for performing photosynthesis and intervenes in protein synthesis and tissue formation. Sulfur is fundamental in the metabolizing of nitrogen, since it improves nitrogen efficiency. Sulfur also improves plant defenses in general. A shortage of sulfur is rare, but when it does occur, the plant becomes lighter in color, taking on a pale green appearance. A general chlorosis is seen, similar to what occurs with a nitrogen deficiency.

Table 2: Macro nutrients characteristics

Characteristics (Macro Nutrients)	Contaminated oil sample (kg/ha)			Field soil (kg/ha)
	Sample 1	Sample 2	Sample 3	
Nitrogen (kg/ha)	252	238	242	250
Phosphorous (kg/ha)	33.63	24	19	16
Potassium(kg/ha)	369.36	156	192	115







4.2 MICRO NUTRIENTS

4.2.1 BORON

Boron can be used along with calcium for creating new plant cells. Boron requirements should be much higher for reproductive growth, pollination and seed growth.(Permissible limit is 10-80 mg/kg)

4.2.2 IRON

Iron is the most important micronutrient for all living organisms, because it plays a critical role in metabolic processes such as DNA synthesis, respiration and photosynthesis.(Permissible limit is 20-1000 mg/kg)

4.2.3 NICKEL

Nickel is also used as a catalyst in enzymes and also used to help legumes for fixing nitrogen. Excess nickel in plants causes chlorosis due to disruption of iron uptake.

4.2.4 ZINC

Zinc is one of the important element among all eight essential elements. It is needed by plant in small amounts. But it is very crucial for plant development. Lower amount of Zn will result in slow growth. Excess Zn make chlorosis.
(Permissible limit is 10-120 mg/kg)

4.2.5 CHLORIDE

Plants take up chloride as Cl- ion from soil arrangement. It plays some significant jobs in plants, photosynthesis, osmotic change. High concentration of chloride can mess lethality up in crops and decrease the yield of plants.

4.2.6 MANGANESE

Manganese (Mn) is very much important for photosynthesis. Lower amount of Mn will result in mottled leaves. Excess Mn make reduction in growth, brown spottling on leaves and shows up as iron deficiency.(Permissible limit - 90-200 mg/kg)

4.2.7 COPPER

Copper activates some enzymes in plants and influences the nitrogen metabolism.(Permissible limit - 10-25mg/kg)

4.2.8 MOLYBDENUM

Molybdenum is used to convert nitrate into nitrite and for fixing nitrogen level.

Table 3: Micro nutrients characteristics

Characteristics (Micro Nutrients)	Contaminated Soil sample (mg/kg)			Field soil
	Sample 1	Sample 2	Sample 3	
Boron	56	43	38	45
Iron	231	167	93	127
Zinc	29	13	25	23
Copper	13	10	8	10
Nickel	15	9	12	0.05
Chlorine	110	139	95	96
Molybdenum	0.02	0.18	0.1	0.15
Magnesium	0.25	0.21	0.3	0.1
Manganese	55	34	51	67

5.SUGGESTONS

The below given suggestion are used to improve the fertility growth of soil and reducing pH of the soil. From the physico chemical treatment pH range is very high. The near by area to the selected site is of vegetation like tomato culture, brinjal.For the growth of vegetables pH range is about 5.5 to 7 only. But in this area pH range is nearly 7.99.So we have to reduce the pH of the soil. If our soil is alkaline means we can lower our soil's pH or make it more acidic by using several product like sphagnum peat, elemental sulfur, aluminum sulfate, iron sulfate, acidifying nitrogen, and organic mulches.

5.1 USE OF BLOOD MEAL AND CHICKEN MANURE

Potassium and phosphorous is very much important for soil growth. If it is present in low quantity it will make deficiency, at the same time if it is high means it will become toxic for plants. Potassium and phosphorous should be in medium range. For reducing the level we have to add the natural materials like blood meal and chicken manure for the growth of plants.

5.2 USE OF LEGUMES

Legumes are the flowering plants that are cultivated in light soil and are used as a subsequent crop for alternating the property of plants and soil. They are mainly used for reducing the soil pH, increase the organic matter, improve the porosity and structure, reduce the soil compaction, diversify microorganism, recycle nutrients, mitigate disease problem.

6. RESULTS AND DISCUSSIONS

Our study area is in contact with textile effluents for past several years. Our present study has an attempt and concluded that the soil surrounded by textile discharge has more impact on physico-chemical characteristics and nutrients required for plant growth. We can bring back the quality degraded soil by using natural poultry manure, blood meal and legumes.

6. REFERENCES

[1] Abrol, Vikas, Wali, Pradeep, pareek, Navneet, Mondal, A.K, Jalali, V.K (2003): 'Edaphic impact of sewage and industrial effluents on soil resources", Indian Journal of Environment Protection **23**(7):741-748.

[2] Manikandan,P.N.Palanisamy,R.Baskar,P.Sivakumar and P.Sakthisharmila.,"Physico chemical analysis of textile Industrial effluents from Tirupur city,TN,India",2015,Vol.No.4,ISSN-2319-8354(E).

[3] Sonikajha and Suneetha V.," Nutrient analysis of soil sample from various place", Indian journal of chemical and pharmaceutical Research,(2015),7(3):291-293,ISSN:0975-7384 .

[4] Mohammad mostafa, Waste water treatment in textile industries-the concept and current removal technology,Vol.7,(2015),ISSN:2220-6663.

[5] Durgesh kumar tripati, Shweta singh, Swati singh, Sanjay Mishra, D.K. Chauhan, N.K. Dubey, "Micronutrients and their diverse role in agricultural crops:advances and future prospective", (2015), 37:139.

[6] Lakshmi D S, Rajani V," Effect of industrial effluents on soil characteristics", International journal of innovative research in science, engineering and technology, Vol.6, Issue 7, (2017),ISSN:2319-8753.

[7] Ewulo, B.S.,Ojeniyi.S.O.and Akanni,D.A,"Effect of poultry manure on selected soil physical and chemical properties, growth, yield and nutrient status of tomoto",Vol.3(9),(2008),ISSN 1991-637X.

[8] Oagile Dikinya and Namasiku Mufwanzala,"Chicken manure-enhanced soil fertility and productivity:Effect of application rates",Vol.7,(2010),ISSN 2141-2391.