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Investigation on Soil and Groundwater Caused by Industrial Waste Water

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ABSTRACT

Development of industrialization affects the environment in different ways by discharging the large amount of effluent as waste water in the surrounding land and water bodies, causing the serious problems to environment. Presently, around 10 billion litres of untreated effluent is produced every day that leads to pollution of natural water resources. The disposal of industrial effluents is a problem of increasing importance throughout the world. In India a huge amount of waste water generated from distillery and paper industries is discharged on land or into the running water. Distillery waste water is characterized by low pH, high BOD and COD values and contains a high percentage of organic and inorganic materials. This waste water also contains considerable amounts of elements like N, P, K, Ca and S. The paper mill effluents are characterized by high values of BOD, COD and wide range of pH, depending upon the source of origin. The N, P and K contents are lower as compared to those in distillery waste waters. Impact of use of these effluents on soil, plant and water bodies is discussed. Use of distillery effluents indicates a significant increase in electrical conductivity (EC), organic carbon, exchangeable Na as well as available N, P and K in soils. Similarly, pH, organic carbon, cation-exchange capacity, available N, P, K and micronutrient content s of soils irrigated with paper factory effluents are reported to be increased. Besides, the use of this waste water increases the exchangeable Na content of soils This may result in the land use becoming non-sustainable in the long run. Wastewater induced salinity may reduce crop productivity. Canal water was containing high COD, BOD values and higher heavy metal content and the soil irrigated with this water was showing the poor status of the nutrients and high contamination of heavy metals. Sampling locations were selected based on waste water discharging points. Collected soil and water samples were analysed for physico-chemical characteristic, heavy metal and sulphide content. The present study was to evaluate the various effects on the soil and groundwater characteristics irrigated with discharged water.

Keywords: Investigation, Soil, Ground water, Industrial, Waste water.

1. INTRODUCTION

1.1 General

It is well documented that environmental pollution depends mainly on human activities (Industry, agricultural cultivations, and domestic use) and to a lesser extent, to other natural phenomena, which contribute to this, like volcanoes, earthquake etc. Moreover, groundwater pollution depends on insufficient management of urban, industrial and domestic wastes, organic compounds and pathogenic microorganisms, which are found in groundwater receivers and soil. Itis generally considered that industrial manufacturing facilities are the major sources of soil and groundwater contamination. However, the populous residential area near plants, high frequency of land transactions due to high cost of land, and high level of public interest cause the investigation and remediation of contaminated industrial sites much more complicated than those in the developed countries. Industries all around the world have become the focus of attention of environment legislators as various types of hazardous and non-hazardous wastes are being discharged from these industries into our environment. The important environmental elements like soil, water and air are being continuously contaminated by toxic pollutants generated from these sources. The types of effluents produced in the textile industries are liquid effluent, solid waste and volatile organic compounds. Now-a-days they have grown in different zones of the country. Because of the increasing demand of fabrics, these industries are still growing with time and have become a great threat to the environment. Like other industries most of the textile industries have no wastewater treatment plant. Consequently, the wastes of these industries are disposed into drains, canals and rivers without treatment and the solid wastes are dumped into surrounding land or water bodies which contaminate the soil or water with highly toxic inorganic or organic pollutants. The continuous receiving of waste water especially by water bodies poses a great threat to the aquatic life. The harmful inorganic and organic substances in the effluent degrade the normal characteristics of water by reducing the oxygen level and changing the composition of existing heavy metals and other organic constituents. As a result, the usual life style of aquatic plants and animals are greatly hampered. The effects propagate through the food chain to affect human life.

The present work aims at studying the elemental levels in a textile industry effluent and their impact on the surrounding environmental components like effluent receiving pond water, the aquatic plant available on the effluent receiving pond and the effluent-affected land soil. The study also included the analyses of similar types of samples collected from a pollution free non-industrial zone for comparison.

1.2 Textile Industry

Textile industries consume a large quantity of water and generate a huge amount of wastewater, which are generally discharged into a common effluent drain of industrial area. The composite effluents from textile industries consisting high concentrations of heavy metals, organic pollutants and toxic colours, which may affect the quality of surface water, soil, ground water and plant tissues of the region. Toxic pollutants may percolate down via soil profile and reach in ground water, which ultimately cause the health hazards among human being and livestock after consumption as daily drinking requirements. The waste water without any treatment may cause adverse effect on the health of human, domestic animals, wildlife and environment. Contaminated ground water has deteriorated the drinking water and impacts on soil systems and crop productivity. Heavy metals are usually present in trace amounts in natural water but many of them are toxic even at very low concentration though many of the metals are essential components of the biological system. Metals such as As, Pb, Cd, Ni, Hg, Cr, Co, Zn and Se are highly toxic even in minor quantity. Increasing quantity of heavy metals in aquatic resources is currently an area of greater concern especially since a large number of industries discharge their metal containing effluents in to fresh water without any adequate treatment. Contaminated water when used for irrigation purpose affects soil quality and crop health of the agricultural system. The textile effluent had consisting high concentration of trace heavy metals and through its accumulation in different trophic levels of ecosystem ultimately cause the health hazards among livestock and human beings. So, it is very much essential to assess the quality of wastewater before discharging it and to develop an economical method for the prevention and control of ground water pollution. Ground water contaminated by textile effluents, has impact on agriculture irrigation, drinking utilities, soil and agricultural systems. So, it is essential to assess the status of industrial effluent and distribution and dispersion of heavy metals in the environment of the vicinity of industrial area.

1.3 Industrial Process

Textile industries are large industrial consumers of water as well as producers of wastewater. Increased demand for textile products, leads to increase in the generation of textile wastewater, which makes the textile industry as a main sources of severe pollution problems worldwide.

The process of adding colour to the fibresis known as dyeing which normally requires large volumes of water not only in the dye bath, but also during the rinsing step. The process of dyeing involves the use of different chemicals like salts, metals, surfactants, sulphide and formaldehyde. There are more than 8,000 chemical products associated with the dyeing process and over 1,00,000 commercially available dyes exist with over 7×105 metric tons of dyestuff produced annually. nearly 1,000-3,000 m3 of water is let out after processing about 12-20 tons of textiles per day. These effluents are rich in dyes and chemicals, some of which are non-biodegradable and carcinogenic and pose a major threat to health and the environment if not properly treated.

Wastewater generated in different production steps of a textile mill have high pH, temperature, detergents, oil, suspended and dissolved solids, dispersants, levelling agents, toxic and non-biodegradable matter, colour and alkalinity. Important pollutants in textile effluent are mainly recalcitrant organics, colour, toxicants and surfactants, chlorinated compounds (AOX). The textile wastewaters are characterized by extreme fluctuations in many parameters such as chemical oxygen demand (COD), Biochemical oxygen demand (BOD), pH and colour.

Colour in the effluent is one of the most obvious indicators of water pollution and the discharge of highly coloured synthetic dye effluents is aesthetically displeasing and can damage the receiving water body by impeding penetration of light. Dyes are recalcitrant molecules which are difficult to degrade biologically. Some of azo dyes are either toxic or mutagenic and carcinogenic. Azo dyes are designed to resist chemical and microbial attacks and to be stable in light and during washing.

1.4 Status Of Textile Dyeing Industry

Textiles exports contribution is 16.63% of India's total exports earnings, and the country's share in the global textiles and apparel market is 3.9% and 3% respectively.

1.5 Status In India

The Indian Textiles Industry has an overwhelming presence in the economic life of the country. Apart from providing one of the basic necessities of life, the textiles industry also plays a pivotal role through its contribution to Industrial output, employment generation, and the export earnings of the country. Currently, it contributes about 14 percent to industrial production, 4 percent to the GDP, and 16.63 percent to the country's export earnings. It provides direct employment to over 35 million. The textiles sector is the second largest provider of employment after agriculture. Thus, the growth and all round development of this industry has a direct bearing on the improvement of the economy of the nation. The close linkage of the industry to agriculture and the ancient culture and traditions of the country makes the Indian textile sector unique in comparison with the textile industries of other countries.

1.6 Status In Tamil Nadu

Tamil Nadu is one of the major textiles exporting regions in the country. The total number of units in Tamil Nadu is 2267. In places like Tirupur (729), Erode (694), Coimbatore (60), Karur (487), Salem (254), Namakkal (270) and Kanchipuram (68) where the dyeing units are located in clusters, Common Effluent Treatment Plants (CETPs) and Individual Effluent Treatment Plants (IETPs) are provided for the treatment of wastewater. Tamil Nadu Pollution Control Board (TNPCB) insists that all the textile processing units provide zero liquid discharge system so as to avoid further contamination of fresh water resources and also to avoid ground water exploitation.

1.7 Textile Dyeing Wastewater

Textile dyeing industry is one of the major industries consuming large amount of water for its various operations and also discharges vast quantity of wastewater. The dyeing wastewater is strongly coloured due to the utilization of various dyestuffs. Colour is imparted to the dyeing effluents by the spent dye bath and unfixed dyes wash off during the washing process. The discharge of effluent contaminates the ground water and the soil. The textile industries use large volumes of water in their operations and therefore discharge large volume of wastewater into the environment, most of which is untreated. The wastewater contains a variety of chemicals from the various stages of process operations which include desizing, scouring, bleaching and dyeing.

The textile industry is distinguished by the raw material used and this determines the volume of the water required for production as well as the wastewater generated. The production covers raw cotton, raw wool and synthetic materials. In this type of production, slashing, bleaching, mercerizing and dyeing are the major sources of the wastewater generated. The main products of the industries are super print, guarantee super print and minibrocade.

The industries consist of various World Health Organization (WHO), each of which carried out different operations and produces one type of specific wastewater. The wastewater contains acid used in desizing, dyeing bases like caustic soda used in scouring and mercerization. It also contains inorganic chlorine compounds and oxidants, e.g., hypochlorite of sodium, hydrogen peroxide and peracetic acid for bleaching and other oxidative applications. Organic compounds are also present, e.g., dyestuff, optical bleachers, finishing chemicals, starch and related synthetic polymers for sizing and thickening, surface active chemicals are used as wetting and dispersing agents and enzymes for desizing and degumming. Salts of heavy metals are also present, e.g., Copper and zinc, and iron (iii) chloride used as printing ingredients. All these wastes are passed into an effluent tank and then drained into a drainage system.

Average dyeing rate is about 90 percent which implies that about 10 percent is the residual dyeing rate in the finishing wastewater, which is the main reason of contamination. pH is another factor in the wastewater; it is usually in the alkaline range because of the alkali used during the finishing process.

The main pollutants in the liquid effluent are organic matters which mainly come from pre-treatment, dyeing and printing processes. Among all the pollutants in the wastewater, the most important components are COD (Chemical Oxygen Demand), BOD (Biological Oxygen Demand), pH, fats, oil, nitrogen, phosphorus, sulphate, and SS (Suspended solids). COD is one of the most significant pollutants in textile industry wastewater.

In the pre-treatment processes of cotton, the average concentration of COD can reach 3000mg/L. In the dyeing/printing processes where the main pollutants are auxiliaries and the residual dyes, the concentration of COD is still as high as 1000mg/L. Table 1 shows the specific pollutants from each process of textile and dyeing.

Table 1: Pollutants from Each Process of Textile and Dyeing

S. No	Process	Compounds
1	Desizing	Size, enzymes, starch, waxes, ammonia.
2	Scouring	Disinfectants and insecticides residues, NaOH, surfactants, soap, fats, waxes, pectin, oils, sizes, anti-static agents, spent solvents, enzymes.
3	Bleaching	H_2O_2, AOX, sodium silicate or organic stabilizer, high pH.
4	Mercerizing	High pH, NaOH
5	Dying	Colour, metals, salts, surfactants, organic processing assistants, sulphide, acidity/alkalinity, formaldehyde.
6	Printing	Urea, solvents, colour, metals.
7	Finishing	Resins, waxes, chlorinated compounds, acetate, stearate, spent, solvents, softeners.

1.8 Environmental Problems Due to Discharge of Effluent

The discharge of effluent contaminates the ground water and the soil. Discharge of effluent into water bodies can upset the penetration of sunlight and biological activity in the water body. It affects photosynthesis of the phytoplankton, retarding the self-purification capacity of the water body. The dye is visible even at small concentrations and the transparency of streams would also be reduced. Colour being an indicator of pollution, hampers the use of water for certain industrial and recreational purposes. Coloured industrial wastewaters are considered to be toxic. Most of the dyes are non-biodegradable and toxic. Azo dyes are considered to be carcinogenic. Many amino substituted azo dyes have been found to be mutagenic as well as carcinogenic. Sulphated azocompounds, which are used as dyes for textiles are reported to be xenobiotic in character.

Tamilnadu's textile city, Tirupur, which has nearly 729 dyeing units, is ranked topmost in terms of generating hazardous waste. The bleaching and dyeing units use large quantities of water, but most of the water used by these units is discharged as effluent, containing a variety of dye and chemical (acids, salts, wetting, agents, soaps, oil etc.). These units discharge nearly 90 MLD of effluents on land or into the Noyyal River, leading to contamination of the ground and surface water and soil in and around Tirupur and downstream. A number of mechanical, thermal and chemical processes are involved in the textile industry and each process has a different impact on the environment. This impact starts with the use of pesticides during the cultivation of natural fiber. During the past few decades, there has been growing awareness of the environmental problems which have become an important issue in the textile trade, thanks to the various environmental and health legislations. Environmental policy is increasingly dictated by market forces.

1.9 Objective of the Study

- To determine the effects of various factors on soil and ground water under the controlled application of industrial waste water.
- To test the effects of using industrial wastewater on the physiochemical properties of the soil by measuring the soil quality parameters before irrigation.
- To determine the fertility of soil and ground water pollution risks associated with these of industrial wastewater.

2. METHODOLOGY

Figure 1 shows the methodology of the study.

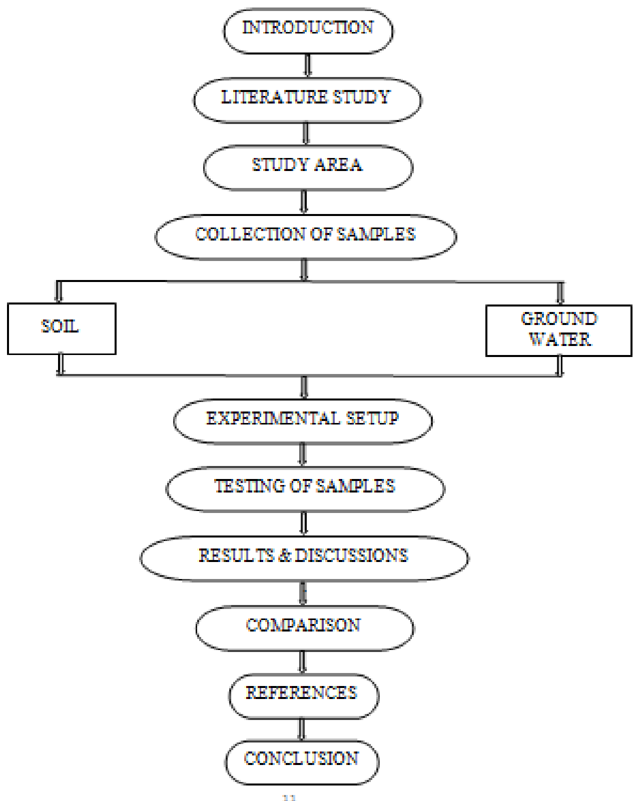

Figure 1 Methodology

3. STUDY AREA

a. District Profile of Karur

Karur is one of the oldest towns in Tamil Nadu and has played a very significant role in the history and culture of the Tamils. Its history dates back over 2000 years, and has been a flourishing trading centre even in the early Sangam days. Epigraphical, numismatic, archaeological and literary evidences have proved beyond doubt that Karur was the capital of early Chera kings of Sangam age. It was calledKaruvoor or Vanji during Sangam days. There has been a plethora of rare findings during the archaeological excavations undertaken in Karur. These include mat-designed pottery, bricks, mud-toys, Roman coins, Chera Coins, Pallava Coins, and Roman Amphorae, rare rings etc. Karurwas built on the banks of river Amaravathithat was called Annaporunai during the Sangam days. The names of the early Cherakings, who ruled from Karur, have been found in the rock inscriptions in Aru NattarMalai close to Karur. The Tamil epic Silapathikaram mentions that the famous Chera King CheranSenguttuvan ruled from Karur. In 150 AD, Greek scholar Ptolemy mentioned "Korevora" (Karur) as a very famous inland trading centre in Tamil Nadu. After the early Cheras, Karurwas conquered and ruled by Pandyas followed by Pallavas and later Cholas. Karur was under the rule of Cholas for a long time. Later the Naickers followed by Tipu Sultan also ruled Karur. The British added Karur to their possessions after destroying the Karur Fort during their war against Tipu Sultan in 1783. There is a memorial at Rayanur near Karur for the warriors who lost their lives in the fight against the British in the Anglo-Mysore wars. Thereafter Karur became part of British India and was first part of Coimbatore District and later during 1920s Tiruchirappalli District. Karur is also a part of Kongunadu. The history of Kongunadu dates back to the 8th century. The name Kongunadu originated from the term "Kongu", meaning nectar or honey. Kongu came to be called as Kongunadu with the growth of civilization. The ancient Kongunadu country was made up of various districts and taluks which are currently known as Palani, Dharapuram, Karur, Nammakkal, Thiruchengodu, Erode, Salem, Dharmapuri, Satyamangalam, Nilgiris, Avinashi, Coimbatore, Pollachi and Udumalpet. Kongunaduwas blessed with abundant natural resources, a pleasant climate and distinct features. Kongunadu was ruled over by the Chera, Chola, Pandya, Hoysala, Muslim rulers and finally the British.

b. Industries

The advantage of a traditional centre of commerce and trade facilitated manufacturing activities in the Karur district especially in textiles. The entrepreneurial urge of the people of Karur was helpful in expanding the manufacturing activities in modern industries since the beginning of 20 century. Besides the Tamil Nadu Paper Limited (TNPL) of public sector, there are many industrial ventures comprising of textiles, cement, sugar and bus body building units in Karur district. The numerous textile units such as the K C P sack manufacturing unit provide ample job opportunities for the people especially the women; in the blocks taken for study, Kulithalai and Thogamalai, the impact of such outside employment was considerable.

i. Paper

Tamil Nadu News Print and Papers Ltd., better known as TNPL the country's largest non-wood-based paper maker was established in the early 80's at Pugalur near Karur. One of the world leaders in the technology for manufacture of newsprint from bagasse, TNPL produces 230,000 tons of Printing & writing paper and consumes 1 million tons of bagasse every year.

ii. Cement

Chettinad Cement Corporation Ltd. at Puliyur, Karur District, in Tamil Nadu commenced production in April 1968. Apart from cement, it has diversified into activities in granite, engineering, silica, garnet, information technology, steel & textile trading, horse breeding, plantations, shipping, transportation, stevedoring, clearing and forwarding and logistics having a combined turnover of Rs.8500 million.

iii. Textile Trade

On the international textile map, Karur is well-known for its handloom "made-ups" and household furnishing materials. The large domestic market for floor rugs, bedspreads, bathing towels etc enabled Karur to expand its production in such items over the years. This strength subsequently was useful in reaching overseas markets. Exports of handlooms from Karur began on a modest scale with just 15 exporters in 1975 and today Karur has hundreds of exporters. The handloom products being exported have been broadly classified under three heads - Kitchen, bathroom and bedroom furnishing items. Some of the handloom made-ups exported from Karur are Bedspreads, Towels, Floor rugs, Tea towels, Napkins, Aprons, Kitchen towels, Pot holders Plate mats, Bath Mats, Tea mats, Curtains, Pillow, Quill covers, Shower curtains etc., The products are exported to Europe, U.S.A., Japan, Canada, Australia, Singapore, South Korea, South Africa and the Scandinavian countries among others. The textile industry of Karur has also diversified into manufacturing of jute sacks, mosquito nets, korai mats etc besides the traditional items. The handloom industry in Karur generates nearly an annual turnover of Rs.2000 Crores (400 million dollars a year) through direct and indirect exports of textile goods. The export growth has facilitated the emergence of other allied industries like power loom weaving units, dyeing and bleaching units, tailoring, packaging units etc. The handloom and its allied industries provide direct and indirect employment to over two lakh persons.

iv. Sugar

The Parry India Limited, the leading sugar manufacturing company in the country, set up its sugar factory in Pugalur, Karur. The company also has a unit in nearby Pettaivaithalai in Trichy district. The factory at Pugalur has a capacity of 4000 TCD. It has a capacity of 4000 TCD per year. It has also planned a 22 MW co-generation Power plant, with TNPL.

v. Bus Body Building Industry

Karur is a renowned centre for bus building industries. A sizable portion of south Indian bus bodies are being built here. In and around Karur, there are several small and large units catering to the needs of bus industry within Tamil Nadu and also outside the state. This industry run entirely in the private sector has generated considerable employment opportunities for both skilled and unskilled labour. It has also created opportunities for the emergence of many related industries.

In our project a specific case study was carried out in home textile manufacturers and suppliers in Karur District.

Textile industries are responsible for one of the major environmental pollution problems in the world, because they release undesirable dye effluents. Textile wastewater contains dyes mixed with various contaminants at a variety of ranges. Therefore, environmental legislation commonly obligates textile factories to treat these effluents before discharge into the surrounding water bodies and land surface.

This paper presents the effect of textile industrial effluent on Ground water and soil. These types of industries are discharging large amount of effluent as waste water. This degrades the quality of the water and land and affects the organisms living in it. This process ranges from simple addition of dissolved or suspended solids to discharge the most insidious and persistent toxic pollutants such as pesticides, heavy metals, and non-degradable, bio accumulative, chemical compounds. This pollution is caused due to Industrial affluent such as paint, dying units etc. In textile production, opportunities exist for the release of potentially hazardous compounds into the ecosystem at various stages of the operation. These pollutants are produced in an effort to improve human standard of living and fashion but ironically, their unplanned intrusion into the environment can reverse the same standard of living by impacting negatively on the environment. Hence this present case study is placed in this context to examine the textile pollutants and their intensity on rural environment with respect to the socio economic and demographic background. This study has captured all available data and understood that while a lot has been done to reduce pollution load in surrounding land and water bodies, more work needs to be done both in terms of policy and implementation.

4. COLLECTION OF SAMPLES

a. Collection of Soil and Ground Water

The soil samples and ground water samples near home textile manufacturers and suppliers in Karur District were collected. After collection of samples, they were sealed tightly and labelled properly.

Experimental investigation was carried out to analyse the impact of textile industry wastewater on soil and ground water quality.

Soil samples prior to analysis, were air dried, ground to fine form, sieved and preserved then used for the determination of soil Bulk Density (BD), Particle density (PD), Electrical Conductivity (EC), Porosity, pH, organic matter, available nutrients N, P, K by adopting standard laboratory method.

5. TESTING PROCEDURE

a. Determination of pHof Water

There are two methods involved in the determination of pH value of water. They are:

- Colorimetric Method
- Electrometric Method

In environmental engineering experiments, every stage of water treatment is dependent on the pH value of the water. For example, the coagulation, disinfection, control of corrosion, acid-base neutralization and water precipitation.

i. Colorimetric Method for pH of Water

Take the pH standard solution and the water that is to be tested. Take the colorimetric paper. Dip this paper on the water sample. The obtained color is computed from the standard table and the respective pH value is recorded. This pH Value will conclude whether the sample of water is acidic or alkaline.

ii. Electrometric Method for pH of water

One of the most widely accepted method for the hydrogen ion determination (pH) is the electrometric method. This method is highly accurate and used in laboratory work and by researchers. The accuracy of the pH value is 0.1 to 0.0001.

b. BOD (Biochemical Oxygen Demand)

BOD is the traditional, most widely used test to establish concentration of organic matter in wastewater samples (i.e., relative strength). BOD is based on the principle that if sufficient oxygen is available, aerobic biological decomposition (i.e., stabilization of organic waste) by microorganisms will continue until all waste is consumed.

The BOD test is also known as "BOD5" since it is based on the accurate measure of DO (dissolved oxygen) at the beginning and end of a five-day period in which the sample is held in dark, incubated conditions (i.e., 20°C or 68°F). The change in DO concentration over five days represents the "oxygen demand" for respiration by the aerobic biological microorganisms in the sample. The five-day completion window is an inherent disadvantage of the test because wastewater treatment system personnel cannot use it to make real-time operational adjustments. An extended UBOD (ultimate BOD) test that measures oxygen consumption after 60 days or more is sometimes required in wastewater permits.

i. BOD Test Procedures

- To ensure proper biological activity during the BOD test, a wastewater sample:
- Must be free of chlorine. If chlorine is present in the sample, a DE chlorination chemical (e.g., sodium sulfite) must be added prior to testing.
- Needs to be in the pH range of 6.5-7.5 S.U. If the sample is outside this range, then acid or base must be added as needed.
- Needs to have an existing adequate microbiological population. If the microbial population is inadequate or unknown, a "seed" solution of bacteria is added along with an essential nutrient buffer solution that ensures bacteria population vitality.
- Specialized 300 mL BOD bottles designed to allow full filling with no air space and provide an airtight seal be used. The bottles are filled with the sample to be tested or dilution (distilled or deionized) water and various amounts of the wastewater sample are added to reflect different dilutions. At least one bottle is filled only with dilution water as a control or "blank."
- A DO meter is used to measure the initial dissolved oxygen concentration (mg/L) in each bottle, which should be a least 8.0 mg/L. Each bottle in then placed into a dark incubator at 20°C for five days.
- After five days (± 3 hours) the DO meter is used again to measure a final dissolved oxygen concentration (mg/L), which ideally will be a reduction of at least 4.0 mg/L.
- The final DO reading is then subtracted from the initial DO reading and the result is the BOD concentration (mg/L). If the wastewater sample required dilution, the BOD concentration reading is multiplied by the dilution factor.

c. Flame Photometer

Flame Photometers by Panomex are digital instruments that are extensively utilized in pharmaceutical and clinical industries to estimate potassium (K), sodium (Na), lithium (Li), calcium (Ca) and barium (Ba) in samples. Other industries where flame photometer instruments are used are: chemical and petrochemical industries, medical colleges, paper, fertilizer, sugar and wine and food processing industries etc.

We present our flame photometer range, enriched with advanced engineering, providing you instruments that are simple, fast and lost lasting in nature. Each model is approximately similar in external design but features specific measurement range capabilities; hence, available in various price range. Each flame photometer model is equipped with soft touch key pad and has different numbers of calibration points i.e., 5 or 3.

Designed for laboratory analysis, Panomex Flame Photometers are extremely user friendly and come with various features to accommodate fast and simple operation. Printer interface is provided to attach DOT matrix printer device in order to keep hard copies of results for further analysis. Selected models feature auto gas cut-off and auto flame failure detection devices. They also have non-corrosive nebulizer.

d. UV Spectrometer

Optical Method with UV Sensor In optical method UV spectroscopy module is used. This deals with the interactions of ultraviolet radiation with the sample under investigation. It is based on the absorption of electromagnetic radiation at wavelengths in the range of 200-400 nm. Molecules containing πelectrons or non-bonding electrons (n-electrons) can absorb the energy in the form of ultraviolet or visible light to excite these electrons to higher anti-bonding molecular orbitals. The more easily excited the electrons (i.e., lower energy gap between the HOMO and the LUMO), the longer the wavelength of light it can absorb. UV spectroscopy follows Beer-Lamberts law. The Beer-Lambert law states that the absorbance of a solution is directly proportional to the concentration of the absorbing species in the solution and the path length. Thus, for a fixed path length, UV spectroscopy can be used to determine the concentration of the absorber in a solution. It is necessary to know how quickly the absorbance changes with concentration. This can be taken from references (tables of molar extinction coefficients), or more accurately, determined from a calibration curve. This energy transmission can be measured as the plot of energy (reflectance, absorption or transmittance) versus wavelength, which is called as a spectrum.

i. Phosphorous Determination inthe Soil

Soil is mixed with distilled water and SSP is added to it. SSP represents Phosphorous ion in the form of phosphate as found in soil. For the first sample 150gm of soil is added with 350 ml of distilled water and 100 gm of Phosphorous ion is added. For second sample 150gm of soil is added with 350 ml of distilled water and 200 gm of phosphorous ion is added and for third sample 150gm of soil is added with 350 ml of distilled water and 400 gm of phosphorous ion is added. These samples were given to Varian 100 Carry spectrophotometer

ii. Nitrogen Determination inthe Soil

Soil and distilled water are mixed with ZnNO3. ZnNO3 represents Nitrogen ion in the form of Nitrate as found in soil. For the first sample 150gm of soil is added with 350 ml of distilled water and 100 gm of Nitrogen ion is added. For second sample 150gm of soil is added with 350 ml of distilled water and 200 gm of Nitrogen ion is added and for third sample 150gm of soil is added with 350 ml of distilled water and 400 gm of Nitrogen ion is added. These samples were given to Varian 100 Carry spectrophotometer

6. RESULT AND DISCUSSION

a. Analysis

Table 2 shows the water sample parameters.

Table 2: Water Sample parameters

Name of the sample		pH	B.O.D (ppm)	TDS	COD	EC	Cl	HCo_3
Sample 1	Before	6.9	2.5	840	4	1283	231	232
	After	7.36	2.7	846	6	1297	238	240
Sample 2	Before	7.3	8.5	6139	27	9271	3647	643
	After	7.88	8.8	6288	38	9598	3819	691

Figure 2 shows the water sample – 1 parameters.

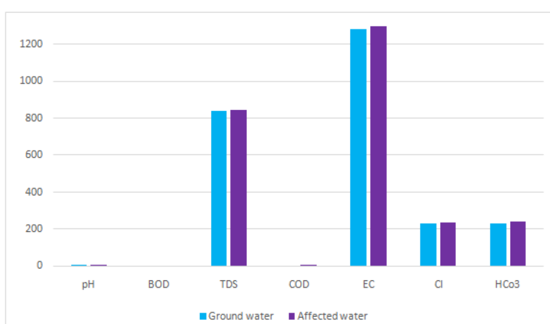

Figure 2 Water Sample-1 parameters

Before and after testing of groundwater parameters are given above. In this comparison of testing result parameters are varied. This water is not suitable for agriculture and drinking purpose. After the water treatment may be it will used for other purposes. Figure 3 shows the water sample – 2 parameters.

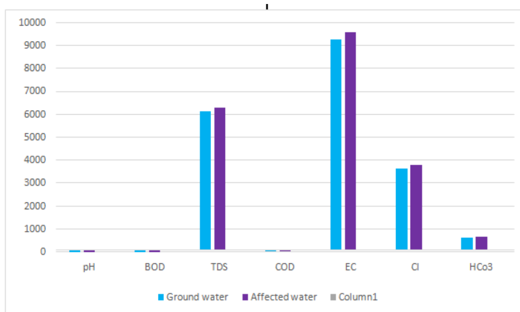

Figure 3 Water Sample-2 parameters

pH value gives amount of the hydrogen ion concentration of water. BIS recommends a pH range of 6.5-8.5 for drinking water. The range of pH value in the study zone was 6.9 to 7.88. The results of pH not satisfy the desirable limits of Bureau of Indian standards. In addition, the table 3 shows the values of the BOD, TDS, COD, EC, Cl and HCo_3. The results are not satisfying the Bureau of Indian standards.

Table 3: Soil parametersfor different types of water

Parameters	Affected soil	Normal soil
pH	7.56	6.10
EC (ds/m)	1.25	0.14
Lead (mg/kg)	2.36	1.37
Cadmium (mg/kg)	1.89	1.10
Nickel (mg/kg)	12	9

Figure 4 shows the soil parameters chart.

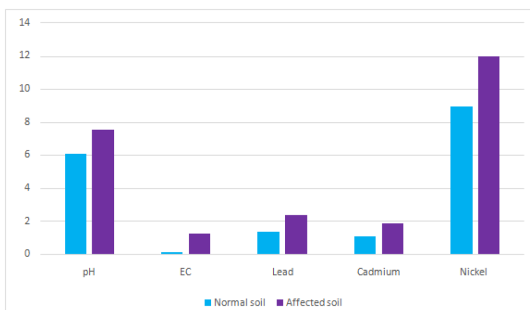

Figure 4 Soil parameters chart

Table 4 shows the organic parameters for different types of water.

Table 4: Organic parameters for different types of water

Soil sample	N (ppm)	P (ppm)	K (ppm)	Cr (mg/kg)
Normal Soil	102	23	20	23
Affected Soil	189	19	189	39

Figure 5 shows the organic parameters of soil.

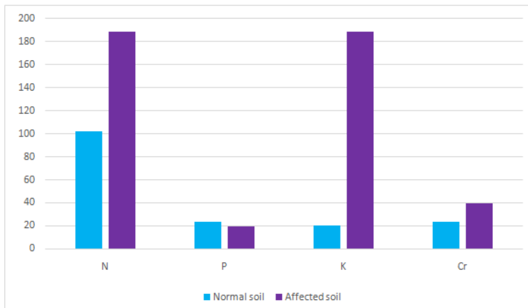

Figure 5 Organic parameters of soil

When you have too much nitrogen in soil, your plants may look lush and green, but their ability to fruit and flower will be greatly reduced. While you can take steps towards reducing nitrogen in garden soil, it's best to avoid adding too much nitrogen to the soil.

Below 30 ppm phosphorus, additional phosphorus must be applied to build up the soil for optimum crop production. Above 50 ppm phosphorus, there will be no benefit to adding additional phosphorus. In some cases, applying a small amount of phosphorus as a starter on soils testing above 50 ppm may be beneficial. In the optimum range between 30 and 50 ppm phosphorus is often recommended to offset crop removal and thus maintain the soil in the optimum range over time.

As important as it is, too much potassium can be unhealthy for plants because it affects the way the soil absorbs other critical nutrients. Lowering soil potassium can also prevent excess phosphorus from running into the waterways where it can increase growth of algae that can eventually kill aquatic organisms.

7. CONCLUSIONS

Water and soil samples are collected from Karur district.The analysis of groundwater is to be carried out with parameters like pH, B.O.D (ppm), TDS, COD, EC, Cl, HCo_3 etc. to get the information about the influence of pollutants on its quality of entire area. Not all the parameters are satisfies which indicate that the need for some kind of treatment to its use for domestic purposes. Soil testing also conducted to check the parameters. The parameters are not satisfies for the purpose of cultivation and plantation. They required some treatment for other purposes.

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