Study of Treated Effluent in Sewage Treatment Plant in Tiruchirappalli

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***Abstract*:- Sewage Treated Effluent Water (STEW) contains some nutrients for agriculture purpose. The treated effluent water is discharge into ground / soil. The environment effect of treated effluent to around Sewage Treatment Plant (STP) can be, positive or negative, in nutrient and physico- chemical properties. The treated effluent can used for agriculture and garden plantation. STEW properties may contain heavy metals, salinity and alkalinity.**

The excessive accumulation of hazardous materials in agriculture ecosystem, which may cause a potential risk to human health in future. This study evaluated the changes on physical, chemical and microbiological characteristics of STEW. The STEW contains innumerous of nutrients to agriculture and it give root to vitamins and protein for root growth.

Keywords: Sewage treated effluent water, physico-chemical properties, heavy metals, salinity and alkalinity.

1. INTRODUCTION

The entire world is facing a water scarcity. The fresh water as less nutrients compare to wastewater. In that wastewater, have more toxicity, oils, and grease. So waste effluent is treat at sewage treatment plant. The waste effluent existed more amount of hazardous and toxicity. It is removed by standard process. The existing of physico – chemical characteristics and biological parameters are controlled and under almost to discharge limits. The acceptable or discharge limits are obey norms of Central Pollution Control Board following a standard conditions under Environmental Policy Act (1990). In India, maximum number of treated effluent from treatment plant is discharge in river and running water. My study explored that the treated effluent water benefits / usage for agriculture and irrigation purpose. The Sewage Treated Effluent contain more number of chemical properties and micronutrients in high. It is possible to increase root growth rate.

Several studies related to effluent from industries as treated or untreated also from treatment plant. My study carried out in Tiruchirappalli sewage treatment plant. Some author's experiments and study conclusions is very useful to carried out my study. All that, ***Anderson Prates Coelho et al. (2020)*** conducted an experiment and result as evaluated the physical quality of the soil after application of TSE for four years. The application of treated sewage effluent does not alter the aggregation, soil penetration resistance, water infiltration rate, porosity, and organic carbon content of oxisol. In regions of high rainfall and in areas with clay soil and those cultivated with perennial grasses, such as urochloa brizantha, irrigation with treated sewage effluent recommended, as it causes no damage to the soil physical quality. Thus, the TSE fertigation can used on many crops as a source of water and nutrients, reducing the environmental contamination potential of the TSE when it discarded directly into watercourses. ***Bhakti Kulkarni et al. (2018)*** conducted an experiment and result as a supply of clean water is an essential requirement for the establishment and maintenance of diverse human activities. Water resources provide valuable food through aquatic life and irrigation for agriculture production. The results indicates all major waste water quality parameters were reduced to much extend after the treatment and treated effluent values were well within limit of discharge into creek as per MPCB. Hence, it concludes that STP based on C-TECH Technology is working with the standards given by MPCB. The results obtained indicates this latest technology is very effective in wastewater treatment.

Andrea F. Brunsch et al. (2019) conducted experiment and result shows that the The research was conducted at a RSF pilot plant under real conditions over a period of six months. The results show that the dual approach is promising and feasible to full scale implementation. Generic compounds that indicate water quality such as TOC, DOC and nutrients that can occur in high concentrations in CSO can be effectively removed in RSF, including biological transformation of ammonia under nitrifying conditions. Additionally, the effective removal of several OMPs from CSO was shown, with best removal for OMPs with highest inflow concentrations such as MTF and CAF. Generic water quality compounds and some of the investigated OMPs appear in STP effluent in lower concentrations as in CSO. In addition, the RSF turned out to further remove residues found in the STP effluent. ***Mohd. Najibul Hasan et al. 2019*** Seven different STPs for domestic wastewater treatment located in Northern India were evaluated for over two years. Five different treatment technologies were studied. Only the STPs based on SBR, MBBR and combined UASB + DHS, based processes produces an effluent quality required for the disposal into surface water bodies. The BOD, COD and TSS removal efficiencies were ranged 63%–95% for all STPs irrespective of the treatment technology used. Present study indicates that all STPs should require proper operation and maintenance. The costs to produce an effluent required to achieve the disposal standards is lowest one between the technologies studied, only 10% higher costs incurred on intensive aerobic processes compared to operated UASB followed by PP or UASB followed by aeration + PP, which produces an effluent not according to standards.

2. MATERIALS AND METHODS

2.1 *Site description*

The specific case of study area carried out in Tiruchirappalli, also known Trichy, is a major tier II city in the Indian state of Tamil Nadu. This city is almost at the geographically center of the state. The sample collected in Sewage Water Treatment plant under control of Trichy City Corporation.

2.2 *Sewage Treated Effluent Sampling*

The effluent samples two set of Sewage Treated Effluent (STE), samples collected. One is after completion of treated process and another is before discharge of effluent in open land or stagnant. The STE sample collected to know for values of physico chemical and biological characteristics. The sewage wastewater contain more number of minerals. So after treated effluent discharge in stagnant or open land under standard norms of ISO, the discharge of effluent water, effluent intrusion into land / running water.

The samples of STE collected from respective study area, sealed tightly after collect, and labelled properly. Samples collected at after treatment in storage tank as Sewage Treated Effluent Sample – 1 (STES 1) and discharge place as Sewage Treated Effluent Sample – 2 (STES 2). Effluent samples were analyzed for parameters, like physical parameters as Color, Odour, Turbidity and Temperature, Chemical parameters as pH, Alkalinity, Nitrate (NO_3), Phosphate (PO_4^{3-}), Sulphate (SO_4^{2-}), Chloride (Cl^-), BOD, COD, Electrical conductivity and Total Dissolved solids and Biological Parameters of Escherichia coli tested or both samples STES 1 and STES 2, the test is done.

3. SAMPLING ANALYSIS

3.1 **Sewage Treated Effluent Sampling Analysis**

Characterization of the Sewage treated wastewater used in this study the parameters evaluated using Indian Standard Protocol of IS 3025 and IS 1622.

Colour is determine by using Spectrophotometric method. Is applicable for all types of water including domestic and industrial wastes. Characteristics of colour is at measure pH 7.6 and spectrophotometer of soil absorption is visible in obtained from original pH of the sample. The percent transmission at certain wavelengths used to calculate the results, which are expressed ill terms of dominant wavelength, hue, luminance and purity. An effective operating range from 400 to 700 nm. In that wavelength explained in IS3025 part 04, 1983. It mentioned unit as Hazen. Odour is determine the true Odour of sample. The determination of Odour using IS3025 part 05, 1983. In case it is not possible to specify the exact nature of Odour, report as agreeable or disagreeable. Turbidity is determine by using prescribes Nephelometric method for the measurement of turbidity of treated water under test in IS3025 part 10, 1984. It based on defined comparison of the intensity of light scattered by the sample under conditions with the intensity of light scattered by a standard reference suspension under the same conditions. The higher intensity of scattered light, the higher the turbidity. Formazin polymer generally used as turbidity standard because it is more reproducible than other types of standards used previously. The unit is NTU. Temperature prescribes for the measurement of temperature of sample under test in IS3025 part 09, 1984. Temperature measurements may made with any mercury-in-glass thermometer provided it be check occasionally against a precision thermometer certified by a competent agency. Depth temperature obtained with a protected reversing thermometer or a thermistor. Thermistors is done for more conveniently for usually temperature Measurement. It is mention as Degree Celsius.

Chemical Parameters of Alkalinity prescribes the potentiometric and indicator methods for determination of alkalinity under test protocol of IS3025 part 23, 1986. These methods are applicable to determine alkalinity in water and wastewater in the range of 0.5 to g 500 mg/l alkalinity as $CaCO_3$. pH prescribes electrometric and colorimetric methods for the determination of pH value test under IS3025 part 11, 1983. Which contain no carbonates but contain bicarbonates and carbonic acid, the pH values of these waters range from 4.5 to 8.0. Most of neutral waters fall under this category. The pH value of neutral water usually lie between 6.5 and 7.5. Chemical Oxygen Demand (COD) prescribes the method for determination of chemical oxygen demand (COD) in treated water under standard method of IS3025 Part 58, 2006. Most of the organic matters are- destroyed when boiled with a mixture of potassium dichromate and sulphuric acid producing carbon dioxide and water. A sample refluxed with a known amount of potassium dichromate in sulphuric acid medium and the excess of dichromate is titrated against ferrous Ammonium Sulphate. The amount of dichromate consumed is proportional to the oxygen required to oxidize the oxidizable organic matter. It unit is mg/l. Biochemical Oxygen Demand (Bod), standard prescribes oxygen depletion method based on bioassay procedure for measurement of biochemical oxygen demand under test protocol of IS3025 part 44, 1993. Test is based on mainly bioassay procedure, which measures the dissolved oxygen consumed by microorganisms while assimilating and oxidizing the organic matter under aerobic conditions. The standard test condition includes incubating the sample in an airtight bottle, in dark at a specified temperature for specific time of 27°C for 3 days respectively. Chloride (Cl) prescribes the method for determination of Chloride in treated water under standard method of IS3025 part 32, 1988. The standard prescribes

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photometric method is suitable for colored or turbidity samples. Chloride is determine by photometric titration with silver nitrate solution with a glass and silver- sliver chloride electrode system. The end of the titration is that instrument reading at which the greatest change in voltage has occurred for a small and constant increment of silver nitrate. Its unit mg/l. Nitrogen (N) prescribes methods for determination under test protocol of IS3025 part 34, 1988. Determine of various types of nitrogen like ammoniacal nitrate, nitrite and organic treated water. The Prescribes a method for determination of nitrite nitrogen using Nessler's cylinders or spectrophotometer. Spectrophotometric method shall be the refree method to evaluate the values. Its unit is mg/l. Sulphate (SO4) prescribes determine the Thorin method in treated water under the protocol of IS3025 part 24, 1986. This method is applicable to surface and ground waters with Sulphate concentration in the range 5 to 150 mg/I. Samples having higher concentrations can measured by appropriate dilution of sample. Sulphate ion is titrated in an alcoholic solution under controlled acid conditions with a standard barium chloride solution, using Thorin as the indicator. Its unit is mg/l. Phosphate (P) prescribes determine the vanadomolybdo - phosphoric acid method in treated water under the test protocol of IS3025 part 31, 1988. This method shall be the referee method. In dilute orthophosphate solution, ammonium moly date reacts under acid conditions to form a hetropoly acid, molybdo - phosphoric acid. In presence of vanadium, yellow vanadomolybdo - phosphoric acid formed. The intensity of yellow colour is proportional to phosphate concentration. Its unit is mg/l. Electrical Conductivity (EC) prescribes a method of treated water under the test protocol of IS3025 part 14, 1984. The determination of specific conductance of water. The electrical conductivity of water extract of effluent sample gives a measure of soluble salt content of the sample. Pure water is very poor conductor of electric current, whereas water containing the dissolved salts in sample conducts current approximately in proportion to the amount of soluble salts present. The conductivity of the water is the specific conductivity at 25°C of water extract obtained from a sample and water mixture of a definite ration. It measured on a conductivity meter and normally reported in dS/m or milim hos/cm and the value gives information on the total amount of the soluble salts present in water, i.e. on the degree of salinity. Total Dissolved Solids (TDS) prescribes a gravimetric method of treated water under the test protocol of IS3025 part 16, 1984. This method determination of filterable residue. The sample is filter and the filtrate evaporated in a tared dish on steam bath. The residue after evaporation dried to constant mass at 103°C
-105°C or 179°C -181°C. Its unit is mg/l. Escherichia coli (E.coli) Biological Parameters of treated water under the test protocol of IS1622, 1981The coliform group includes the entire aerobic and facultative anaerobic gram negative, non-spore forming rod shaped bacteria, which ferment lactose with gas formation within 48 hours at 37°0. The standard test for the estimation of number of the coliform groups may carried out either by the multiple tube dilution test (presumptive test, confirmed test, or completed test) or by the membrane filter technique. Its unit MPN/100 ml.

4. RESULT AND REPORT

Table 4.1 Characteristics of Sewage Treated Effluent Samples Result

S. No	TEST PARAMETER	UNIT	STES 1	STES 2	ACCEPPTABLE LIMIT
PHYSICAL PARAMETER					**Indian Standard**
1	Colour	Hazen	BQL[LOQ-1.0]	BQL[LOQ-1.0]	5
2	Odour	-	Disagreeable	Disagreeable	Agreeable
3	Turbidity	NTU	8.10	7.30	1
4	Temperature	° C	28.0	28.0	17.4 - 23.7
CHEMICAL PARAMETER					
5	Alkalinity	mg/l	356.10	313.74	< 200
6	Ph@25°C	-	7.92	7.74	6.5 - 8.5
7	Electrical conductivity	µS/cm	1241.08	1159.0	< 400
8	Chemical Oxygen Demand	mg/l	128.35	99.80	75 - 100
9	BOD,3 days@ 27°C	mg/l	35.09	21.0	30 to 40
10	Chloride as Cl	mg/l	275.48	269.91	< 250
11	- Nitrate as NO3	mg/l	4.45	4.31	< 45
12	- Sulphate as SO4	mg/l	58.50	57.36	< 200
13	Phosphate	mg/l	2.05	1.83	< 0.5
14	Total dissolved solids	mg/l	1075.80	908.0	< 500
BIOLOGICAL PARAMETER					
15	Escherichia Coli	MPN/ 100ml	62.75	60	0

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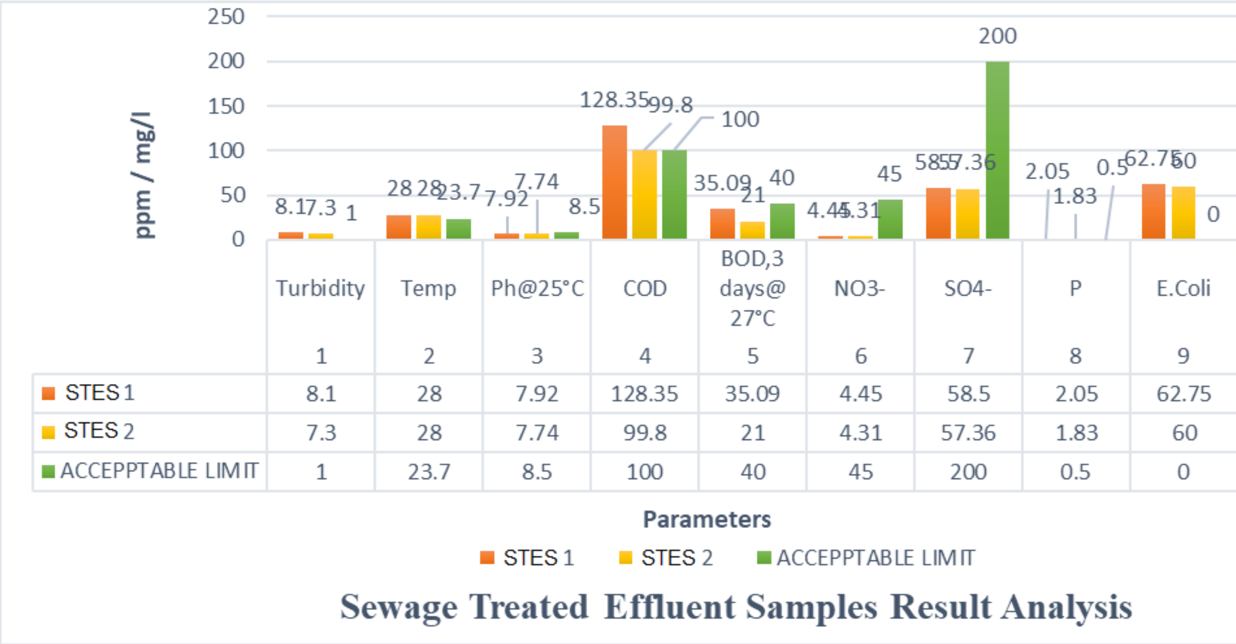
Figure 4.1 - Characteristics of Sewage Treated Effluent Samples Result in Graphical Representation



Showed in Table: 4.1 The Sewage Treated Effluent analysis characteristic of Physical Parameter of Colour, Odour, Turbidity and Temperature are more than permissible limit of Drinking Water BIS: IS 10500: 2012. The chemical Characteristics of pH, COD, BOD, NO3 ¯ and SO4¯ are in under acceptable limit of BIS. The Alkalinity, EC, P and TDS are more than the required level of acceptable limit. In that the effluent which is discharge in wetland, soil may affect the pH and Alkalinity. The TDS is high in value it change water a bitter, metallic or salty taste, along with discoloring the effluent. E.coli in water to land make various effects and changes in soil bacteria and it effect the plant root cell and make cancer to plant root. The treated effluent contain more nutrients than the fresh water to plantation and sustainable plant growth.

5. CONCULSION

The result of the experiments shows that, the long-term discharge of sewage treated effluent in open land, the slightly increasing the level of P and K in soil which make it as fertilizer to give vim to soil. Mn is the important parameter in soil for plantation growth and metabolic growth. In treated effluent, it has permissible limits. The pH is the basic Characteristic of soil in acidic or alkaline.

The STE continuous discharge in land the characteristic of soil is slightly may change inn future; at same time, STES 2 results shows Phosphate and chloride and alkalinity are has more than required level of nutrients to crop plantations. In that, use short-term irrigation or E.coli will affect the plant root.so that before use the water boil at 55 to 60°C and cool it to use for Long-term Irrigation and sustainable crop production.

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