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To Study the Effect of Municipal Treated Effluent on Groundwater Quality Near Sewage Treatment Plant, Davangere

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Abstract - *The work was performed to examine the treated effluent mannerism and its impact on groundwater around the Sewage treatment plant. The main objectives of this work are to appraise the effectiveness of the treatment procedure and to identify the potential hazards related to release of treated effluent into the environment. The findings will help environmental authorities, wastewater treatment facilities, and local communities create more sensible plans for managing wastewater sustainably and safeguarding soil and groundwater resources. The release of effluent to ground it reaches ground water, as a result, groundwater potability and usability can be harmed. It is advised to conduct further investigations to monitor the broader implications and put essential precautions in place to reduce potential hazards to the environment and public health*

***Key Words*: Sewage treatment plant, Treated effluent, Groundwater**…

1. INTRODUCTION

Water, food and energy are important and are vital issue face by whole world. Most of revers, canals and other surface and subsurface water sources are majorly polluted and are toxic for usage their experiencing moderate to severe water shortage across the globe and their effecting urbanization, industrialization and agriculture growth. The per capita water consumption has been increased significantly due to rapid growth of population and standard of living [2]. Waste water or low-quality water are major source of demand management after the treatment for general usage such as for gardening, washing, and for coolant for an industrial application. Water which is adversely affected by anthropogenic influence are termed as waste water. The liquid waste that is discharged from household and other commercial properties are termed has wastewater [1]. Due to rapid urbanization, growth of population, standard of living and development of industries leads to sever challenge for the disposal of sewage or sewage treatment plant effluent. Due to ensuring demand for water, the practice of domestic sewage in farming became more common or practicing way of handling sewage or sewage effluent. Irrigation with sewage is important in arid and semiarid region, which is economical to freshwater. The benefits of sewage irrigation are more but preventionary measures are to be taken in order to avoid environmental risk. Sewage irrigation or farming is n of the techniques to decrease the load on recycle and reuse. Available natural resources, sewage farming is away to meet the demand for freshwater. Sewage will improve the physiochemical characteristics of soi, since sewage contains essential nutrient such as N, P, K and macronutrients which will promote plants growth.

1.1 Repercussion of Effluent on Groundwater

Groundwater is natural water source which plays important role in satisfying the water demand for various purpose in dry and droughty regions. Quality of groundwater is considered as finer than surface water, since soil columns purifies the water through various processes such as anerobic decomposition, filtration, ion exchange etc., Over exploitation of groundwater leads to lowering of water table and quality deterioration. The groundwater is recharged mainly through rainfall and seepage of surface water bodies such as rivers lakes etc., Contamination of groundwater will damage the ecosystems that depend on it, such as wetland habitat rivers, and lakes, which will lead to loss of biodiversity and hazardous ecosystems. Individuals who ingest contaminated groundwater or come into connection with it will catch waterborne diseases such as cholera, typhoid, hepatitis, and gastroenteritis via pathogens that inhabit sewage. Significant amounts of nutrients like nitrogen and phosphorus are occasionally detected in sewage. These nutrients are capable of causing eutrophication when they accomplish groundwater, which disrupts aquatic life leading to in algal blooms and oxygen depletion in surface water bodies that receive flow from the groundwater [3].

2. METHODODLOGY

The methodology involves the selection of study area and the sample collection and analysis of the various parameters by various laboratory method.

2.1 Study Area

Davanagere, a city in the heart of Karnataka, is being developed as government's Smart City initiative. The Sewage treatment plant is existed in Davangere and it is 5 km far away to the Davangere city. Sewage The villages like B. Kalpanahalli, Shivanagara, Doddaboodihal, Chikkaboodihal are located near the treatment plant. Doddaboodihal and Chikkaboodihal are chosen for sampling and analysis which is near to the Sewage Treatment Plant. The communities of Doddaboodihal and Chikkaboodihal use this treated wastewater as their prime source of water for farming.

2.2 Gathering Samples

The effluent samples are gathered from Doddaboodihal, Chikkaboodihal villages at the distance 100m, 200, 300m, 350m, 400m and labelled as sample 1, sample 2, sample 3, sample 4, and sample 5 accordingly. The underground water samples are collected in plastic bottles and are stored in refrigerator to avoid ingrowth of organic material care should be taken such that samples were not allowed for freezing since it has an effect on the equilibrium of sample.

2.3 Experiment Conduction

In this study the parameters analyzed for the effluent and groundwater are pH, Electric Conductivity, Color, Alkalinity, Total Dissolved Solids, Turbidity, Dissolved Oxygen, Chloride, Biological Oxygen demand and Chemical Oxygen Demand.

The pH, EC, Turbidity and TDS is measured using a pH meter, Conductivity meter, Turbidimeter and TDS meter respectively. Color is determined by spectrophotometer and Chloride is determined using the Mohr's method. Alkalinity and DO are determined using standard titration method, for BOD analysis the sample is incubated for 3 days and for COD determination COD digester is used to heat the sample to oxidize organic and inorganic substances, and followed back titration.

3 RESULTS AND DISCUSSIONS

The outcomes of the analysis of the study are presented in this chapter for various parameters of the sample are discussed along with graphs.

3.1 Analyzed Characteristics of Disposed Treated Effluent

The analyzed various parameters of the disposed treated effluents of five samples and their outcomes are tabulated in the below table 3.1. Some parameters like EC, Color, TDS are reducing with the flow of effluent.

Table -3. 1: Analyzed Characteristics of Disposed Treated Effluent.

Parameters	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
pH	7.68	7.59	7.39	7.32	7.29
EC (ms/cm)	989	984	983	963	928
Color (PtCo)	302	279	241	237	234
TDS (ppm)	702	680	647	620	618
Turbidity (NTU)	74	73.9	63.4	61.4	50.4
COD (mg/lit)	214.8	179.24	146.93	217.84	223.47
BOD (mg/lit)	106.9	88.47	73.37	106.74	111.61

3.2 Analyzed Characteristics of Groundwater

The analysis of the underground samples which are collected near the sewage treatment plant for agricultural perspective parameters. The outcomes of the analysis are tabulated in the below table 3.2.

Table -3. 2: Analyzed Characteristics of Groundwater.

Parameters	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
pH	7.12	7.22	7.24	7.28	7.34
EC (ms/cm)	2.09	1.68	1.59	1.54	1.17
Color (PtCo)	73	47	23	14	12
Alkalinity (mg/lit)	464	456	397	384	280
TDS (mg/lit)	1226	1086	763	743	578
DO (mg/lit)	6.71	7.24	8.06	8.46	8.7
Chloride (mg/lit)	263.48	240.91	223.93	151.95	147.98

The pH of all the samples analyzed are within the limit 6.5 – 8.5. The pH results of samples are 7.12, 7.22, 7.24, 7.28, 7.34 for sample 1, sample 2, sample 3, sample 4 and sample 5 respectively are shown in figure 3.1 below. All the samples are fit for human consumption and irrigation. The pH of all the samples is alkaline in nature.

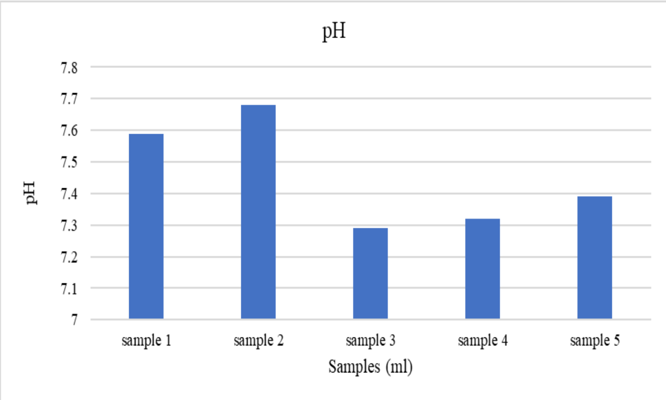

Figure 3. 1: pH of Groundwater

The EC of analyzed sample are represented in below figure 3.2. Electrical conductivity of samples is within the limits 3 prescribed by BIS 3.5 mS/cm. The EC of samples 1, sample 2, sample 3, sample 4, and sample 5 are 2.09mS/cm, 1.68mS/cm, 1.59mS/cm, 1.54 mS/cm and 1.17mS/cm respectively. Water dissolves wide range of substances, including salts, acids and bases. When these substances dissolve in water, they break down into ions, which are positively or negatively charged. These ions allow the flow of electric charges through it, leading to electrical conductivity of water.

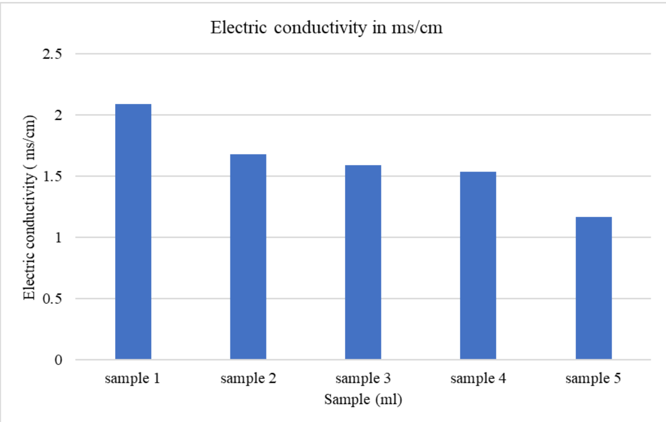

Figure 3. 2: EC of Groundwater

The color of analyzed groundwater samples is shown in below figure 3.3. The color of sample 1, sample 2, sample 3 are 73PtCo, 47PtCo, and 23PtCo are more than permissible limit of 15PtCo prescribed by BIS are aesthetically unfit for drinking purpose and can be utilized for irrigation, washing, gardening etc., The color of sample 4 and sample 5 are 14PtCo and 12PtCo respectively are aesthetically accepted for drinking purpose.

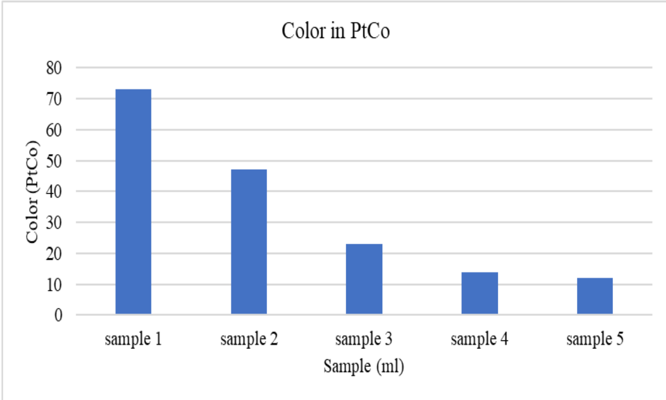

Figure 3. 3: Color of Groundwater

The Alkalinity of evaluated GW samples gathered are show in below figure 3.4. Alkalinity of the samples are within the acceptable limit of 600mg/l which can be utilized for dinking purpose. The alkalinity of sample 1, sample 2, sample 3, sample 4, and sample 5 are 464 mg/l, 456mg/l, 397mg/l, 384mg/l, and 280mg/l as $CaCO_3$ respectively.

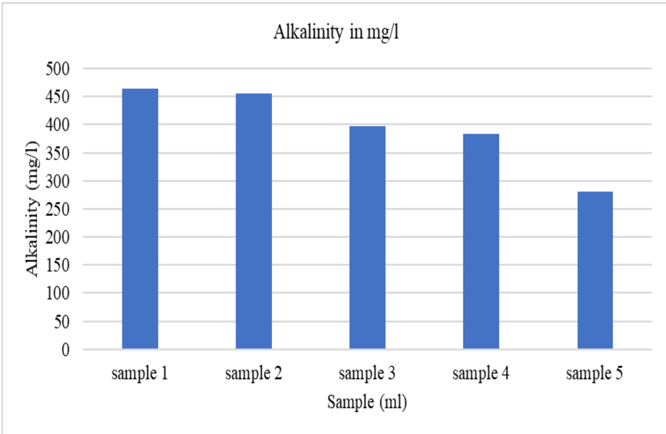

Figure 3. 4: Alkalinity of Groundwater

The results of DO of analyzed underground water samples are given in below fig 3.5. The DO of analyzed samples is within the permissible limit 6-9mg/l, so all the water are fit for human consumption and poses no immediate health risk to human health. The DO of sample 1, sample 2, sample 3, sample 4 and sample 5 are 6.71 mg/l, 7.24mg/l, 8.06 mg/l, 8.46mg/l and 8.7mg/l respectively.

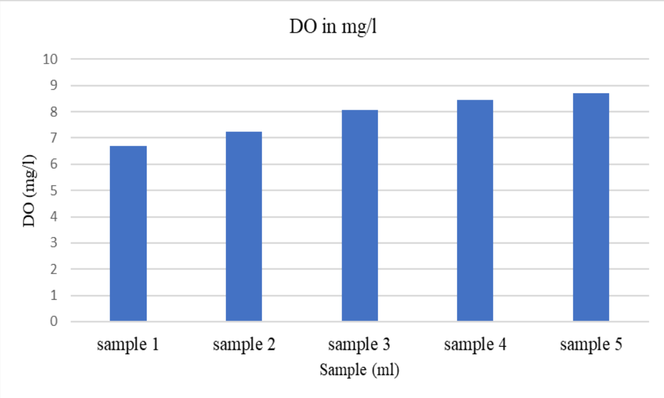

Figure 3. 5: DO of Groundwater

The chloride content of evaluated GW samples is represented in fig 3.6. The chloride content of all the sample is within the permissible limit of 250mg/l. Thus, makes water fit for drinking purpose as well for irrigation purpose. The chloride content of sample 1, sample 2, sample 3, sample 4 and sample 5 are 263.48mg/l, 240mg/l, 223.93mg/l, 151.95mg/l and 147.98mg/l respectively.

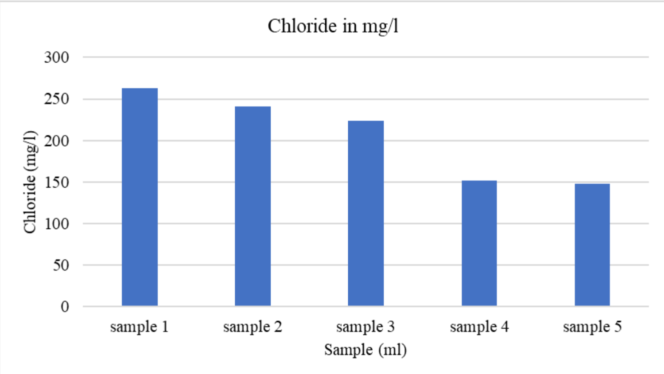

Figure 3. 6: Chloride of Groundwater

4. CONCLUSIONS

The analysis of treated effluent and groundwater in the studies area indicates that the majority of the parameters remained within the limits are employed for agricultural application and suitable for the irrigation. The use of treated effluent for agricultural use and irrigation will help to conserve freshwater resource and recycle water for farming. As long-term use of treated effluent for irrigation, the location closer to the sewage treatment facility has more contaminated groundwater than the site farther away. The groundwater's EC, color, TDS, alkalinity, and hardness are all over the allowable limit. Regular water quality testing, monitoring adherence to regulatory requirements are crucial to guarantee the secure of ground water near the sewage treatment plant for agriculture. Assessing the safety and viability of using groundwater so close to sewage treatment facility will be done with assistance of local authorities and water management specialists.

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