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Assessment of effluent quality for irrigation: a case study of gmrit sewage treatment plant

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ABSTRACT

The demand for freshwater is increasing due to growing population and their increased needs. Wastewater is emerging as a potential source for demand management after essential treatment. The treated wastewater can be used for irrigation purpose due to increased water scarcity. This study assessed the water quality of effluent sample collected from sewage treatment plant of GMRIT. The present works was carried out by collecting effluent water samples to assess the effluent water quality for its suitability for irrigation purpose. The main aim of this study is to compare the effluent water quality with reference to irrigation standards. Water quality parameters such as pH, turbidity, chlorides (Cl), sodium adsorption ratio, BOD, COD, iron (Fe), electrical conductivity (E.C), sulphate (SO_4^{2-}), nitrates (NO_3^-), and zinc (Zn) were analyzed. These parameters were estimated using standard procedures and the results were compared with irrigation quality standards. The results indicated that the some of the water quality parameters that is zinc and COD which exceeds the permissible limits of irrigation standards.

KEYWORDS

Heavy metals;
Irrigation standards;
Sewage treatment;
Water quality.

INTRODUCTION

Water is the most essential resource for survival of life on Earth. Water appearance depends on its physical and chemical properties[1]. The disparity in the demand and supply of water resources will become a common major issue opposing many countries around the world as well in the next few decades[2]. Its demand will continue to grow and proper management of the water resources is a challenge for the power[3]. Wastewater recycle is the first step of water demand managemen for minimizing environmental pollution. Wastewater is produced from domestic activities such as dish washing, laundry and bathing, and black water which consist toilet water[4]. Wastewater can be reused which decrease the fresh water demand and discharge of treated water to the environment. Waste effluent has been

always a good target of wastewater improvement and reuse. The use of waste water is mostly for irrigation[5]. The demand for quality water resources in the irrigation sectors will be difficult to meet in the near future because of diminish supply[2]. The monitoring of water quality is one of the major tools for sustainable development and provides important information for water management. The problem associated with the quality of water is a topic of prime importance in the world and getting popularity for research purposes. Therefore, it is necessary to examine the quality of waste water and knowledge of extent of pollution become essential in order to preserve the valuable sources of water for future generations. The present work is carried out in sewage treatment plant of GMRIT area, Rajam, Srikakulam District, Andhra Pradesh. The area is recognized as an educational area by the Government of India. The present study assessed the water quality by using the various physical, chemical, biological parameters in the area. The water quality has been assessed for both dry and wet seasons over a period of 3 months. The assessment has been done with respect to common water quality parameters like chloride, p^H, electrical conductivity, nitrates,sulphates, chemical oxygen demand, biochemical oxygen demand and heavy metals.

MATERIALS AND METHODS

The waste water samples were collected from study area in the months of November, December& January (winter). Water samples were collected using spot sampling procedure[6] from the sewage treatment plant of GMRIT area of Rajam. The samples were put to examination in the laboratory to analyze physical and chemical parameters. These include pH, electrical conductivity, chloride, nitrites, sulphates, heavy metals viz. Zn and Fe. The analysis of water samples was done using standard procedures[7] and all analysis was done in triplicate.

RESULTS AND DISCUSSION

Water quality parameters

Water pH is one of the most important aspects of water quality. Chemical and biological reactions are directly dependent upon the pH of water system. The pH of waste water obtained in range from 7.35. The acceptable limit for the irrigation water standard is 6.5 – 8.5[6]. The results showed that all the samples are within permissible limits. The pH of water samples in waste water is higher in November month compared to December and January whereas the pH of waste water is higher in December and January than that of the November month.

Electrical conductivity is a measure of water capability to transmit electric current and also it is a tool to assess the purity of water. The electrical conductivity in the water samples as an indication of dissolved ions. In the present work conductivity of ground water samples are in the range from 1134-1140 mhos/cm, all the water samples are found to be below the permissible limit. The higher values of EC indicate the sample contains higher levels of dissolved ions[8].

The concentration of chloride in the groundwater samples ranged from 134.5-135.5 mg/L. The amount of chloride ions recommended being acceptable by irrigation standards[6] is within 600 mg/L. The results indicated that samples with in the permissible limit. This may be due to water contamination as a result of seepage from septic systems, landfill, fertilizers or animals[8]. Nitrate contents are found to be ranging from 0.12 to 1.11mg/l. The desirable limit for nitrate is to be nil in irrigation standards. Nitrate concentrations over 1mg/L should not be used for irrigation. Nearly 90% of the samples with in the permissible limits. The nitrate concentration in waste water is almost same in all the months.

Sulfate can be found in almost all natural water. The samples contain the sulphate concentration in the range from 0.12-0.11 mg/L. The desirable limit for sulphate is below 1000 mg/L. This may be due to water contamination as a result of sewage wastes.

COD can be found in almost all waste water. The samples contain the COD concentration in the range from 88-94mg/l. The desirable limit for COD is to be nil in the irrigation standards.

BOD can be found in almost all waste water. The samples contain the BOD concentration in the

TABLE 1 : Water quality parameters of effluent sample from sewage treatment plant of GMRIT

parameters	Season 1 November	Season 2 December	Season 3 January
p^H	7.35	7.43	7.35
Electrical conductivity(mhos/cm)	1134	1140	1140
Turbidity(NTU)	0.6	0.5	0.7
Chlorides(mg/l)	135.45	134.9	135.55
Sulphates(mg/l)	0.12	0.13	0.11
Nitrates(mg/l)	0.12	0.11	0.11
BOD(mg/l)	3.3	3.1	3.2
COD(mg/l)	94	88	89
Iron(mg/l)	1.5	1.45	1.6
Zinc(mg/l)	4.88	4.9	4.8
SAR	26%	28%	30%

range from 3.1-3.2mg/l. The desirable limit for BOD is below 100mg/l in the irrigation standards.

Sodium adsorption ratio(SAR) is the most commonly used for evaluating water suitability for irrigation purposes. The samples contain the sodium adsorption ratio concentration in the range from 26%-30%. The desirable limit for SAR is should not exceed 60% in irrigation waters[8].

Rapid sewage treatment plant results more effluents discharged in various water resources. These effluents are usually treated by physicochemical treatment process. The effluents containing trace metals, when discharged on agricultural land for irrigation, increase the metal content of the soils and availability of metals to plants. Trace metals are widely distributed in the environment with sources mainly from weathering of minerals and soils[9-10]. However, inputs from anthropogenic activities have increased the levels in the environment tremendously[11-12]. Some of the metals are of concern because of their toxicity to plant (Zn) while others (Fe) are hazardous to human health.

The concentration of Zn in the water samples ranged from 0.01 to 0.4 mg/l. The permissible limit of Zn concentration in irrigation water is to be nil. It was observed from the data that all the samples were above the permissible limit of irrigation standards.

The concentration of Fe in the water samples ranged from 1.647 to 1.823mg/l. The permissible limit of Fe concentration in irrigation is to be 10mg/l. It was observed from the data that all the samples were below the permissible limit of irrigation standards. The reason for elevated metal content in the samples was due to the increased human influence on waste water[13]. The assessed water quality parameters of the effluent samples are listed in TABLE 1

CONCLUSIONS

The waste water samples from sewage treatment plant of GMRIT area were assessed for their quality in terms of usage of treated water for irrigation purpose. The results indicated that chlorides, sulfates, nitrates, SAR and BOD concentrations were within the permissible limits and COD is not within the permissible limits. The elemental concentrations of Zn were found to exceed the permissible limits of irrigation water quality, whereas Fe concentrations are within the permissible limits. This research may serve as a preliminary study to provide baseline information that may direct future water quality assessment studies in the study area.

REFERENCES

[1] A.Jafar Ahamed, S.Ananthakrishnan, K.Loganathan, K.Manikandan; Assessment, Appl Water Sci., **3**, 763–771 **(2013)**.

[2] S.H.Lln, H.Y.Chan, H.G.Leu, H.Y.Chan, H.G.Leu.; Desalination, **128**, 257-267 **(2000)**.

[3] J.Illueca-Muñoza, A.J.Mendoza-Rocaa, A.Iborra-Clara, A.Bes-Piáa, V.Fajardo-Montañanab, F.J.Martínez-Franciscoc, I.Bernácer-Bonorac, De-

salination, **222**, 222–229 **(2008)**.

[4] H.Al-Hamaiedeh, M.Bino; Desalination, **256**, 115–119 **(2010)**

[5] Seong-Keun Yim, Won-Young Ahn, Geon-Tae Kim, Gi-Won Koh, Jaeweon Cho, Seung-Hyun Kim; Pilot-scale evaluation of an integrated membrane system for domestic wastewater reuse on islands, Desalination, **208**, 13–124 **(2007)**.

[6] A.K.De; Environmental chemistry, 2nd Edition, Wiley Eastern publication, **(1998)**.

[7] APHA, Standard method for the examination of water and wastewater,19th Edition, American Public health Association, Washington D.C., **(1995)**

[8] M.Ackah, O.Agyemang, A.K.Anim, J.Osei, N.O.Bentil, L.Kpattah, E.T.Gyamfi, JEK.Hanson; Assessment of groundwater quality for drinking and irrigation: The case study of Teiman-Oyarifa Community, Ga East Municipality, Ghana, Proceedings of the International Academy of Ecology and Environmental Sciences, **1(34)**, 186-194 **(2011)**

[9] E.Merian; Metals and their compounds in the environment: Occurrence, Analysis and Biological Relevance, Wiley, USA, **(1991)**.

[10] P.O.'Neil; Environmental chemistry, Chapman and Hall, London, UK, **(1993)**.

[11] B.E.Prater; The metal content and characteristics of Steework's effluents discharging to the Tees estuary, Water Pollution Control, **74**, 63-78 **(1975)**.

[12] M.R.G.Sayyed, M.H.Sayadi; Variations in the heavy metal accumulations within the surface soils from the Chitgar industrial area of Tehran, Proceedings of the International Academy of Ecology and Environmental Sciences, **1(1)**, 36-46 **(2011)**.

[13] P.Malleswara Rao, G.Venkata Rao, S.K.Beebi; Heavy metal transport in kolleru Lake Basin, Indian Journal of Environmental protection, 899-904, **(2005)**.