Assessment of Ground Water Quality Near Muncipal Dump Site and Estimation of Water Quality Index by using Weighted Arithmetic Method Tenali, Guntur District, Andhra Pradesh, India

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Abstract: ***The present study discuss about the ground water pollution near the municipal dump site of Tenali town, Guntur district, Andhra Pradesh. Tenali municipality is following the open dumping process such that there will be a huge problem to environment as well as human health. Dump site in Tenali is a non-engineered, improper and low-lying area. Dump site do not have any leachate collection point. Therefore the Leachate that is generated is percolated into landfill in the wet and rainy seasons. The study proposes the design of landfill for a municipal dump yard. Ground water samples are collected by fixing the landfill as centre and selecting the four cardinal points around the site. The samples were collected in the poly-ethylene bottles. The samples are tested for physical, chemical and biological parameters to estimate the level of pollution. The results were compared with Indian standards of drinking water (BIS-10500-1991). By using the weighted arithmetic method the water quality index is analyzed. This study is a reference to implement the best suitable technique to suggest the land fill. The construction of landfill will help the dump site for not allowing the Leachate to percolate into the soil and preventing from damaging the aquifer. The research suggest to upgrade of municipal dump to landfill for the protection of ground water.***

Index Terms:-water quality index (WQI), weighted arithmetic method Leachate, Municipal solid waste(MSW), Indian standards

I. INTRODUCTION

Municipal dump is one the major threats to the ground water resources. Waste that are placed in the open dumps are infiltration from precipitation. These gets into the anaerobic decomposition and a material called Leachate is formed. This contains heavy amount of organic as well as inorganic compounds. This Leachate is produced under the dumpsite by the wastes dumped and percolates into soil. Areas which are near to the dump yard has a greater risk to ground water pollution. Analytical lab experiments have used to know the contamination of ground water and in this paper it is assessed by weighted arithmetic method and the impacts of Leachate passing into aquifer and polluting the ground water. Hence ground water quality is estimated from the nearby residential areas as well as in and around the dump site of Tenali, Guntur district Andhra Pradesh.

Various physic-chemical parameters are tested in the collected ground water sample to know the quality of water. The major threatening areas near to the site is noticed. Hence by suing water quality index we can determine the quality of water. the impact of Leachate on the quality of surface and ground water and proposed measures for pollution remediation. Proposed a method of rehabilitation and prevention of further pollution by applying of Membrane Bio Reactor (MBR) plants for treatment of municipal, industrial and Leachate from informal landfills,. that embrace the method of stabilization of residual sludge [1]. Indiscriminate dumping of municipal solid waste without proper solid waste management practices should be stopped or some remedial measures were needed to be adopted to stop contamination [2]. the ground water quality is assessed near municipal landfill and it can moderately impact the ground water and landfill site [3]. Investigation of Ground water Quality near a Municipal Landfall Site upgrading of dumpsite is mostly recommended to prevent contamination of groundwater within the Areas [4].

A. Landfill processes Biological Degradation

Refuse is approximately 75 to 80% organic matter, composed mainly of proteins, lipids, carbohydrates (cellulose and hemicelluloses) and lignin's. Approximately two third of this material is biodegradable. One-third is recalcitrant. The biodegradable portion can be further divided into a readily bio-degradable fraction (food and garden wastes) and moderately biodegradable fraction(paper, textiles and wood). Fig. 1 shows Organic fraction in refuse source.

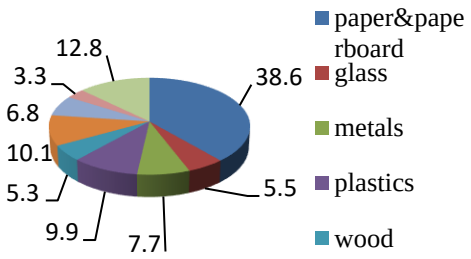

Fig. 1: Organic fraction in refuse source

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II. STUDY AREA

Tenali is a town in Guntur district of the state of Andhra Pradesh. It is a municipality and head quarters of the Tenali revenue division. The city is a renowned for art, culture, drama and hence it is often referred with the nick name as Andhra Paris. It is also a part of Andhra Pradesh capital region(CRDA).According to population17th populous city in the state with the population of 1,64,937. Tenaali is located in the coastal Andhra region of state. Tenali is located 28km east of the district head quarters Guntur and 37km south of Vijayawada. Tenali has only one Dump site to the eastern side of the town located in the burripalem road. This dump site located in the middle of the residential area. Almost all the waste that is generated in the town is dumped in this dumpsite. This specific dumpsite is aged more than 50 years. The total area of the dump site more than 45 acres in which all the area in the dumpsite for dumping the waste openly. Tenali dumping ground lies in 16.2395º N and 80.6493º E. The whole area is Low-lying and being very close to residential area. The dump site is in-proper open dump site. Garbage collected from the town is brought in irregular way. By lack of legislation and management practice all the waste that is generated was only dumped at site. Fig. 2 is a Map showing tenali municipal landfill site and Fig. 3 is Municipal dumpsite in Tenali.

Fig. 2: Map showing tenali municipal landfill site *(source:www.google.in)*

Fig. 3: Municipal dumpsite in Tenali

TABLE I: Co-ordinates of locations

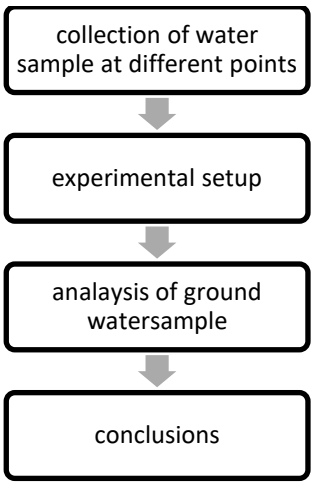
S.No	Sample No.	Source	Longitude	Latitude
1	S1	TUBE WELL	16.239657	80.663103
2	S2	TUBE WELL	16.238311	80.664363
3	S3	TUBE WELL	16.238694	80.665765
4	S4	TUBE WELL	16.238422	80.666498
5	S5	TUBE WELL	16.237101	80.667436
6	S6	TUBE WELL	16.236941	80.668220
7	S7	TUBE WELL	16.236965	80.668748

Fig. 4: Places of samples collected *(source:www.google.in)*

III. RESEARCH SIGNIFICANCE

This paper aims to detect the amount of ground water pollution near the municipal dump site in Tenali and to propose a suitable landfill design for Tenali town municipality Dump site. Analysis the level of most pollution in the nearby residential areas. The major risk in the Ground water in the nearby residential Ares is high traces of chlorides. Due to the high amounts of chlorides there is a high risk in human as well as domestic health.

IV. MATERIALS AND METHODOLOGY FIELD SAMPLING AND LABORATORY ANALYSIS



Flowchart: Methodology

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To investigate the amount of ground water pollution. Seven samples were collected designated S1 to S7were selected making site as centre and selected four cardinal points and collecting samples with equal distance from the site. Field sampling was done at month of November-2018.Details are presented. Water samples are collected in 1 lit bottles. As a part of quality control water bottles are washed properly. After the bottles are filled with sample they are sealed. each bottle is named according to sample collected. All samples are stored in laboratory to perform experiments. From Each sample location 1 liter(1000ml) samples are collected. The collected samples were collected for were tested for Ph, Conductivity, TDS, COD, BOD, Hardness, TDS, TSS, Dissolved Solids. Along with the Municipal landfill area the samples are collected in the nearby Residential Areas. Table II shows Physio-Chemical Parameters.

A. CALCULATION OF WATER QUALITY INDEX (WQI)

Step 1: Collection of data for various physio- chemical water quality parameters along the collection points.

Step 2: Proportionality constant " K " value using formula k

$$s_i = (1/(1/\Sigma\ ^{n}_{i=1}))$$

where "s_i" is standard permissible of nth parameter.

Step 3: calculate quality rating for nth parameter(q n)where there are n parameters. This is

calculated using formula

q n=100 {(v n-v io)/(s n-v io)}. Whereas v n = Estimated value of nth parameter of the given

sampling station. v io= Ideal value of nth parameter in pure water. And s

n=Standard permissible value of the nth parameter.

Step 4: Calculate unit weight for the nth parameters. Wn=(k/s n).

Step 5: Calculate Water Quality Index (WQI) using formula, WQI = ((Σw n* q n)/Σ w n).

B. Water Quality Index (WQI)

Water Quality Index Level	Water Quality Status
0-25	Excellent Water Quality.
26-50	Good Water Quality.
51-75	Poor Water Quality.
76-100	Very Poor Water Quality.
>100	Unsuitable for drinking.

Source - (chatterji and raziuddin,2002)

TABLE II: Physio-Chemical Parameters

Parameters	S1	S2	S3	S4	S5	S6	S7
pH	7.8	7.2	7.3	7.4	7.7	7.3	7.2
Electricity conductivity	0.3	0.4	0.3	0.5	0.3	0.2	0.4
Turbidity	8.91	30.9	8.56	9.18	14.2	22.1	12.6
Alkalinity	18	20	14	16	18	18	22
Acidity	12	9	8	11	7	12	9
Fluorides	0.03	0.03	0.03	0.03	0.05	0.15	0.03
Dissolved Oxygen	0.2	0.3	0.2	0.4	0.2	0.5	0.3
Total Dissolved Solids	330	427	120	125	240	125	148
Total Suspended Solids	251	245	255	266	264	233	245
Total Solids	5.25	6.1	5.50	5.2	5.6	6.1	5.9

Fig. 5 shows the Physio-Chemical Parameters of collected samples.

V. RESULTS AND DISCUSSIONS

The results were compared with World Health Organization (WHO). It is found that the results obtained from the study area are some within the limits and some not within the limits. It is due to high population and industrialization. The soil stratigraphy of the specific site is of black cotton soil. Where there is high probability of Leachate entering into limits. It is due to high population and industrialization. The soil stratigraphy of the specific site is of black cotton soil. Where there is high probability of Leachate entering into the ground water and contaminating them. The specific site is suitable for landfill construction and design such there we can decrease the amount of pollution.

Table III: Water Quality Index by WAM

S.NO	PH	EC	turbidity	alkalinity	acidity	Total chloride	Dissolved oxygen	TDS	TSS	Total solids	Σqi	WQI
S1	7.8	0.3	8.91	18	12	38	0.2	330	251	5.25	377.6	34.7
S2	7.2	0.4	3.09	20	9	70	0.3	427	245	6.1	399.7	42.8
S3	7.3	0.3	8.56	14	8	50	0.2	120	255	5.50	424.13	54.2
S4	7.4	0.5	9.81	16	11	30	0.4	125	266	5.2	274.8	26.8
S5	7.7	0.3	14.2	18	7	10	0.4	240	264	5.6	431.2	54.8
S6	7.3	0.2	22.1	18	12	20	0.3	240	233	6.1	377.8	34.72
S7	7.2	0.4	12.6	22	9	35	0.3	148	245	5.9	536.24	72.4
K	1.06	0.47	0.014	0.056	0.017	0.035	0.01	34.2	27.4	0.56		
wi	0.03	0.02	0.03	0.02	0.02	0.03	0.05	0.02	0.04	0.03		
si	7.9	0.6	28.2	29.4	26.4	105	0.6	365	472.4	12.18		

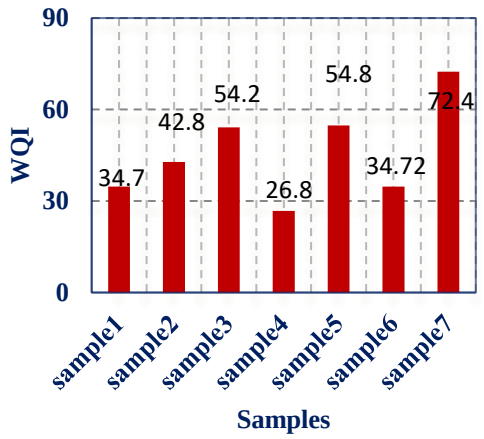

Fig. 5: Physio-Chemical Parameters of collected samples

A. General Description

Chlorides are widely distributed in nature as the salts of sodium (NaCL),potassium(KCL)and calcium(CaCl2)

B. Physicochemical Properties

Chlorides are leached from various rocks into soil and water by weathering. The chloride ion is highly mobile and is transported to closed basins or oceansChlorides are one of the most common harmful contaminants in the ground water. Chlorides occur naturally ion ground water but it is harmful when there is excess amounts of traces. In the specific scenario chlorides are found in higher concentrations because of the existence of municipal dumpsite and higher Leachate accumulation.

C. Comparison of Chlorides from Sample and Trail

Fig. 6 shows the comparison of chlorides from sample and trail.

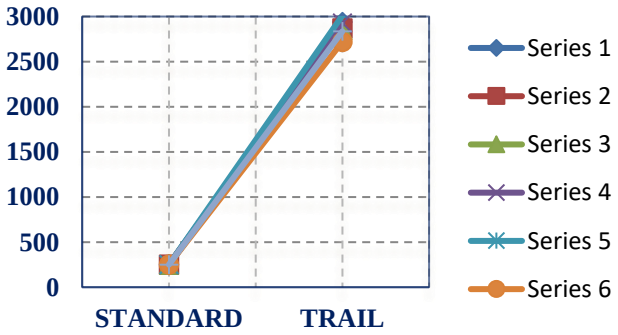

Fig. 6: Sample and trail

VI. CONCLUSION

The Municipal waste disposal system presently used in Tenali is a improper dumping of waste that is generated in all the residential as well as commercial areas of the town.. Burripalem dump site is improper and doesn't have any precautions followed by administration as it is harm for environment also. Burripalem dumpsite in Tenali can easily cause a serious groundwater pollution in the nearby residential areas. The present study was taken to know the hign concentration of polluting contaminants in the groundwater from the period due to the percolation of such contaminants from dumpsite. Groundwater. The Dump site is aged more than 50 years. The ground water quality of specific area is estimated by using different physio-chemical parameters such as Ph, EC, hardness, alkalinity, acidity, chlorides, turbidity chlorides, dissolved oxygen. The data collected is during the month of September. The WQI readings shown using the weighted arithmetic water quality index is written in the Table III. The result of analysis of groundwater samples show that Leachate is a serious threat to the local aquifer. The chlorides exceed the acceptable limit almost in 80% of the samples. This shows the contribution of Leachate on the groundwater. The moderately high concentration of EC, TDS, in Groundwater samples near the dumpsite shows the deteriorated quality of the Groundwater which cannot be used for drinking and other domestic purposes. However, the traces of some pollutants do not over reach drinking water standard even then the ground water quality shows a notable threat for human health. Immediate prevention should be taken the groundwater supply from this region and precise remedies should be taken to decrease future contamination of Groundwater

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