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RESEARCH ARTICLE

ANALYSIS OF PHYSICOCHEMICAL QUALITY PARAMETERS OF GROUND WATER NEAR MUNICIPAL SOLID WASTE DUMPING SITES AT PIPARIYA.

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Abstract

Ground water contamination is generally irreversible i.e., once it is contaminated it is difficult to restore the original quality of water. The effect of municipal solid waste dump on ground water quality at Pipariya, Madhya Pradesh was investigated. Physicochemical quality parameters such as temperature, total dissolved solids, pH, electrical conductivity, alkalinity, total hardness, phosphate, chloride, residual chlorine, were analyzed in groundwater samples. Water samples were collected from many sample stations (hand pumps and bore-wells) from different locations near to a municipal solid waste dump site. The present study is an attempt to observe the existence of pollution in ground water quality and its ill effects on human beings who settled near the dump site at Pipariya Municipal Council (PMC). During the study it was found that total dissolved solids (TDS), electrical conductivity (EC), exceeded the World Health Organization (WHO) tolerance levels for drinking water.

Introduction:-

Ground water is the principal source of drinking water in both urban and rural areas. The importance of ground water for the existence of human society cannot be overemphasized[1-3]. The quality of ground water depends on various chemical constituents and their concentration, which are mostly derived from the geological data of the particular region. Landfills used for *dumping* refuses and municipal *wastes*, contribute ground water pollution[4-7]. Water pollution refers to any type of aquatic contamination rendering the water body poisoned by toxic chemicals which affect living organisms. The contamination occurs through leakage, which is formed when rain water infiltrates the landfill and dissolves the solute fraction of the waste and the soluble product formed as a result of the chemical and biochemical processes occurring within the decaying wastes[8-12].

Pipariya is a Municipality city in district of Hoshangabad, Madhya Pradesh. Due to the uncontrolled and unscientific dumping of municipal solid wastes, all the water bodies near to the dumping sites at Pipariya gets polluted with toxic materials. The high rate of exploitation of ground water than its recharging, inappropriate dumping of solid and liquid wastes are the main causes of deterioration of ground water quality. Therefore the present study deals with assessment of ground water (drinking water) quality near municipal solid waste dumping sites in Pipariya.

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Materials and Methods:-

Study area:-

The study area selected was the urban area of the city. The present solid waste disposal site of PMC is located at Sandia Road which the extreme north-east area of Pipariya. Municipal wastes dumped on this site are largely from domestic and commercial sources. No scientific method of waste disposal is adopted.

Sampling:-

Selection of the sampling sites was done on the basis of the overall objective of the present study. In all total five sampling sites were selected within 0.50 km radius of the landfill site from where the groundwater samples were taken to assess the status of ground water quality at Pipariya. Water samples were collected in clean 500 ml plastic bottles after the extraction of water either from a bore-well or a hand pump. All the collected samples were immediately transported to the laboratory, stored at 4°C and analyzed the same day.

Physicochemical Analysis:-

It is very essential and important to test the water before it is used for drinking, domestic, agricultural or industrial purpose. All the samples were analyzed for relevant physicochemical parameters according to internationally accepted procedures and standard methods[13]. The samples were analyzed for following physicochemical parameter, temperature, electrical conductivity, turbidity, pH total hardness, total dissolved solids, dissolved oxygen, total alkalinity, chloride, calcium, magnesium, iron, and sulphate (mg/l) etc. All The reagents used for the analysis were AR grade and double distilled water was used for preparation of solutions.

Results and Discussion:-

The results of the physicochemical analysis of the groundwater samples are presented in Table-1. Temperature of the Ground Water sample was recorded as to be normal as per the desirable range. Temperature of groundwater sample slightly varied ranged from 26.0 to 27.5

Table 1:- Physicochemical Parameters.

SN	Parameters	Sample Sites									
		Site -1		Site -		Site -3		Site -4		Site -5	
		I	II	III	IV	V	VI	VII	VIII	IX	X
1	Temperature	26.2	26.0	27.1	26.6	26.1	26.8	27.5	27.2	27.0	26.9
2	pH	7.82	7.79	7.91	7.84	7.93	7.85	7.78	7.93	7.83	7.87
3	Turbidity	5.3	6.1	5.5	5.6	5.4	5.7	5.5	5.8	6.0	5.6
4	EC	885	910	883	890	892	889	908	904	894	888
5	TDS	901	888	898	891	903	887	890	900	907	904
6	TA	138	140	138	138	142	139	136	134	140	135
7	Cl^-	245	253	250	249	251	248	246	252	244	251
8	TH	383	375	378	380	384	386	379	391	389	394
9	DO	2.6	2.8	2.4	2.6	3.0	2.9	2.5	2.7	2.8	2.8
10	NO_3^-	4.1	3.9	4.0	3.8	3.7	3.9	3.6	4.0	3.8	3.5
11	F-	0.11	0.09	0.12	0.10	0.08	0.11	0.10	0.09	0.10	0.9
12	SO_4^{2-}	112	109	129	118	127	122	116	119	99	108
13	PO_4^{3-}	10.1	9.9	9.6	10.0	9.7	10.2	9.8	10.1	9.5	9.8
13	Ca^{2+}	150	147	153	148	152	154	146	152	151	153
14	Mg^{2+}	143	147	150	144	145	149	146	151	154	147
15	Fe^{++}	0.16	0.14	0.12	0.13	0.17	0.20	0.18	0.14	0.16	0.15

The pH of the groundwater samples is useful for the calculation of acidity and alkalinity, and important factor in maintaining the carbonate and bicarbonate system. The pH of the groundwater samples were from 7.79 to 7.93. The pH value of all the samples shows the water is neural in nature. The values of pH are within desirable limits (6.5-8.5).

Turbidity of groundwater samples obtained from 5.1 to 6.1NTU. EC is a measure of total salt content in water[14]. EC ranged between 885µs/cm to 910 µs/cm. TDS indicates the general nature of water quality or salinity[15]. During the study TDS is found between ranged 887 mg/l to 907 mg/l. The TDS concentration was found to be above the

permissible limit may be due to the leaching of various pollutants into the ground water which can decrease the potability and may cause gastro-intestinal irritation in human.

The total alkalinity was found to be in the range of 134 to 142 mg/l in ground water samples which are caused mainly due to OH^-, CO_3^{2-}, HCO_3^- ions[16].

The total hardness of ground water samples were found in the range of 375 to 394 mg/l which is further compared with the standard value ranged 300 mg/l. Water hardness is usually due to the multivalent metal ions, which comes from minerals dissolved in the water. The hardness of water is not a pollution indicator parameter but it indicates water quality mainly in terms of calcium and magnesium. The desirable limit for hardness is 300 mg/l and the permissible limit in the absence of alternate source is 600 mg/l.

The value of chloride obtained 244 to 253 mg/l as presented in table which is further compared with the standard values 250 mg/l. Chloride is not harmful to human at low concentration but could alter the taste of water at concentration above 250 mg/l.

DO of ground water samples were found in the range of 2.4 to 3.0 mg/l. due to the capacity of water to hold oxygen[17]. The concentration of nitrate was found in water sample up to 4.1 mg/l. have also reported increase in nitrate concentration in ground water due to waste water dumped at the disposal site and likely indicate the impact of leachate.

The concentration of fluoride in the studied water samples ranged from 0.08 to 0.12 mg/l. The concentration of fluoride at low concentration in ground water has been considered beneficial but high concentration may causes dental fluorosis (tooth mottling) and more seriously skeletal fluorosis[18].

Concentration of sulphate in water sample ranged from 99 mg/l to 129 mg/l. Sulphate is a non toxic anion but ailment like catharsis, dehydration and gastrointestinal irritation have been linked with it when concentration is high[1-20].

Phosphate may occur in surface and ground water as a result of domestic sewage, detergents, and agricultural effluents. The phosphate content in the study area was found in all sites from 9.5 to10.2 mg/l.

Calcium and Magnesium are measured by complexometric titration with standard solution of ETDA. The values of Calcium in water samples were found in the range of 146 to 153mg/l. and Magnesium ranged from 143 to 151 mg/l.

Iron occurs in waters in varying degrees depending on the geology of the area. The iron content of water samples ranged between 0.12 and 0.2 mg/L.

Conclusion:-

The study assessed the evolution of water quality in ground water of Pipariya near MSW. On the basis of current investigation we can conclude that the ground water near the MSW dumping areas most of the under permissible limit of WHO but some of the achieving near permissible limit. A comparative study of ground water i.e. bore well and hand pump water carried out by taking certain important parameters like pH, TDS, TA, Nitrate, Cl^-, PO_4^{3-}, F^- etc. In this present investigation it was found that the maximum parameters were not at the level of pollution except few parameters like nitrate, TDS and TH in ground water.

Therefore, the best accepted option is to avoid the possibility of polluting the ground water resources and municipal solid wastes dump in controlled and scientific way at dumping sites.

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