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Impact of solid waste dump on ground water quality in the village Kasaba-Bawda, Kolhapur district, Maharashtra, India

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ABSTRACT

Water is essential for all life forms on the earth. Clean water for drinking is a major requirement for healthy society. Water for human society is mainly available from two major sources to fulfill most of the human needs, Surface Water and Ground Water and is largely affected by pollution of these sources. The present investigation was planned assess the Ground Water Quality at Kasaba-Bawda village in Karveer Tahasil of Kolhapur District of Maharashtra. Water samples from eight discrete locations comprised of Open Wells, Tube-Wells and a Fixed Masonry Reservoirs were chosen based on their distance from polluting source identified were selected for the Ground Water sampling to study the impacts of solid waste dumping on the Ground Water Quality of publically available drinking water sources at selective locations. The quality was assessed in terms of major parameters. The pH varied between 6.5 to 7.1, hardness between 173 to 422 mg/L and presence of organisms (MPN) including that, the water from the water sources located in the vicinity of solid waste dumping sites were slightly polluted making the water unfit for drinking.

Key words: Groundwater, Water Pollution, Water quality, Surface water, Tube well.

INTRODUCTION

In India, water comes from different sources such as rivers lakes, ponds, wells and tube- wells. This water is consumed for a number of purposes namely domestic, industrial utilization, gardening and agricultural irrigation. In all these consumptions the quality of water is a very important since entire economics with respect to water procurement, its treatment and supply depends on the quality of water. In cities and towns water is mainly taken from rivers and other surface water bodies and is supplied to the population after a suitable treatment [1]. However, in rural areas, the water needs of people are catered mainly by open and tube wells. These wells are classified as shallow, medium and deep wells and fetch water from aquifers occurring in the geological formation of permeable zones of rocks, sand and gravels. The quality of ground water mainly depends on the soil strata, through which it percolates and nature of aquifers where it gets stored. The water is becomes unfit for consumption if it gets polluted by one or the other reason. Disposal of solid waste, leachate formation and its subsequent percolation can contaminate the groundwater. The rapid industrialization, urbanization increased rate of population growth, changing life styles and standard of living have put more pressure on water sources to satisfy water consumption requirements of respective areas. Both the quality and quantity of water have become prime concern [2, 3]. To tackle the supply and demand statistics is really a challenging task.

In present case study the village represents a typical rural community which relies on ground water sources for its day to day needs. In contrast with surface water pollution, ground water pollution is difficult to detect and hard to control. Only some natural processes like wetlands can help to reclaim the water before it gets percolated in ground

[4] and reduce the contamination. The study was conducted on the quality of ground water in the vicinity of solid waste dumping depots and compaired with sites located at the distances more than 10 km from such dumping depots.

MATERIALS AND METHODS

A case study with respect to ground water quality assessment was undertaken at village Kasba-Bawda, in Karveer of Kolhapur District, (M.S.) for checking the ground water quality in the areas of solid waste dumping depots and other locations far from such dumping locations. Village Kasaba-Bawda is at about ten kilometers from the Kolhapur city. The village people depend on ground for their daily water requirement in many parts of the village.

A systematic planning was made to sample the ground water for its quality assessment to insure the impact of solid waste dumping. For the present study, eight locations were identified from the Kasba-Bawda Village for ground Water sampling.

Table 1: Description of ground water sampling locations

Sr. No.	Location of water sampling	Brief description of location of water sampling
1	OW1	Ground water from open well near the solid waste dumping depot
2	OW2	Ground water from open well far from the solid waste dumping depot
3	OW3	Ground water from open well near the solid waste dumping depot
4	OW4	Ground water from open well far from the solid waste dumping depot
5	TW1	Ground water from tube well far from the solid waste dumping depot
6	TW2	Ground water from tube well near the solid waste dumping depot
7	TW3	Ground water from tube well near the solid waste dumping depot but near to sewage flow
8	WTP	River water pumped, treated in water treatment plant and stored in mensory construction

The ground water samples were collected from eight sites out of which four were located in the vicinity of solid waste dumping stations and rest were from distant locations. These locations comprised of four open wells, three tube wells, as well as fixed masonry constructed water reservoirs of river pumped water after treatment. While identifying the location a thought was given to topography of the area, population density and probable sources of contamination etc. All the eight locations were monitored for six months from September to February to evaluate the average level of pollution. The samples were collected once a month and analyzed for physical, chemical and bacteriological parameters. The physical analysis included tests for turbidity, Total Solids TS), Total Dissolved Solids (TDS) and Total Suspended Solids (TSS). The chemical test included determination of pH and hardness were as the bacteriological analysis included test for Most Probable Number (MPN), and Standard Plate Count (SPC). The standard methods were used for the present study[5].

RESULTS AND DISCUSSION

During the survey and sample collection exercise a standard questionnaire was prepared due to which, interviewing people, data Collection and its processing became much easier. The questionnaire and monthly variation of ground water characteristics are not included in the paper as these are beyond the scope of this paper. Results of the analysis for ground water samples collected at the eight different locations have been summarized in Table 2.

Table no: 2 Average characteristics of water samples from different study locations in comparison with the permissible limits (*WHO. 1971)

Sr. No.	Parameters	Permissible Limits (WHO, 1971)	Open Well (OW1) Near the Dumping site	Open Well (OW2)	Open Well (OW3) Near the dumping site	Open well (OW4)	Tube Well-1 (TW1)	Tube Well-2 (TW2) Near the Dumping site	Tube Well-3 (TW3)	WTP stored in mensory fixed construction (WTP)
1	pH	6.5-9.2	6.8	7.0	6.5	7.0	7.1	6.7	7.0	7.0
2.	Turbidity(NTU)	5-25 NTU	21.5	15.1	21.4	16	17	21.3	15	18
3.	Hardness(mg/l)	600	269	315	422	217	323	405	212	173
4.	Ca (mg/l)	200	130	66	109	72	78	156	82.	50
5.	Mg (mg/l)	150	80	29.5	24	15	29	66	37	21.2
6.	TS (mg/l)	1500	2320	695	1875	810	610	2705	570	437
7.	TDS (mg/l)	---	1832	385	1460	380	398	1678	345	165
8.	TSS (mg/l)	---	243	310	415	430	212	1027	225	272
9.	MPN(Per 100 ml)	Nil	$\geq$2400	$\geq$2400	320	Nil	Nil	$\geq$2400	24	Nil
10.	SPC/ml	100 Cells	$3050x10^3$	$1054x10^6$	$2259x10^3$	N. E.	$1096x10^5$	$1096x10^5$	N. E.	68

**WHO, 1971 Standards: Santra S.C., 2001[6].*

From the personal discussion with people residing in Kasaba-Bawda village and from data collected during survey it was observed that about 30 % of village residents occasionally use water from open wells and tube-wells for drinking purpose mainly during summer season. The water from these sources was being generally utilized for washing clothes, utensils and animals washing regularly. The major source of drinking water was treated water from river Panchaganga flowing at the distance of about 3 Km away from the village. The water is lifted by pumping and received to the water treatment plant (WTP) and then distributed to villagers after chlorination which is subsequently stored in fixed mensory constructions. However during extreme summer condition the villagers consume water from the open- wells and tube- wells. The ground water contamination by solid waste dumping has been noticed by many workers [7,8,9]. Such contamination of ground water by discharge of untreated industrial effluent in industrial belts has been studied and reported by many workers [10,11,12,13].

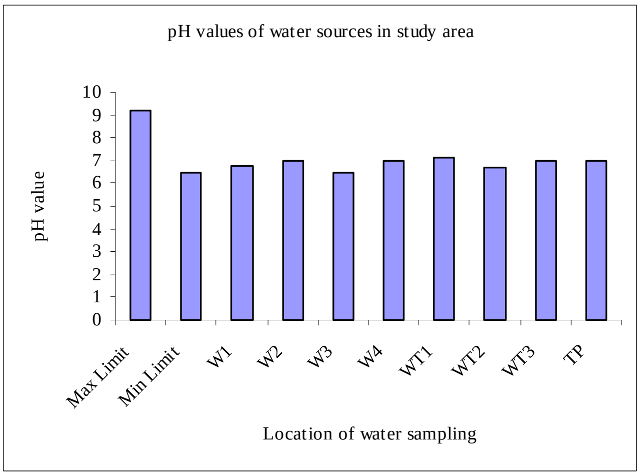

Fig.1: Comparison of pH values of water sampled from study area

Results of analysis of water samples for pH showed that pH of all water samples were in the permissible limits (Fig.1). The lowest pH (6.5) was recorded for the open well 3 (OW3) pH was 6.8 at open well 1(OW1) and 6.7 at tube well 1 (TW1) located near solid waste dumping areas which is attributed to the percolation of solid waste leachate. The pH of water was either neutral at open well 2 (OW2) and open well 4 (OW4) as well as at tube well 3 (TW3) and water treated in plant (WTP) stored in fixed mensory construction tanks. It was slight alkaline (7.1) at open well 1 (TW1).

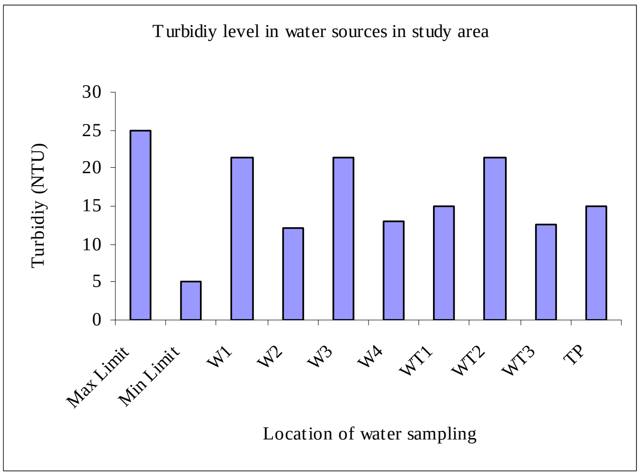

Fig.2: Comparison of turbidity levels in water sampled from study area

Turbidity and hardness levels were in the permissible limits in all water samples. In the geochemical investigation on inorganic constituents by in the ground water surrounding the dumpsite area at Muzzaffarpur found increase in hardness and pH beyond standard limits ([14,15]. In present study, the hardness was found slightly increased, but pH was found decreased. The turbidity was relatively higher in the water from water resources located near solid waste dumping areas (Fig.2). The highest level of hardness (422 mg/L) was recorded in open well 3 and lowest (173) was in the treated water (WTP) stored in fixed mensory constructed tanks (Fig.3). Calcium and magnesium contents were within the permissible limits in all water samples studied (Fig. 4 and Fig.5).

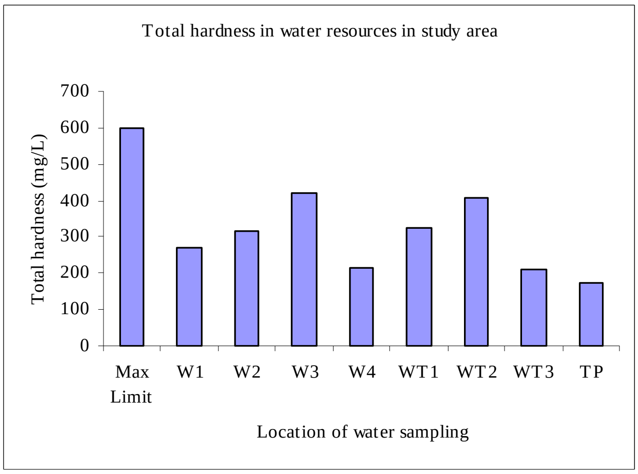

Fig.3: Comparison of Total hardness content in water sampled from study area

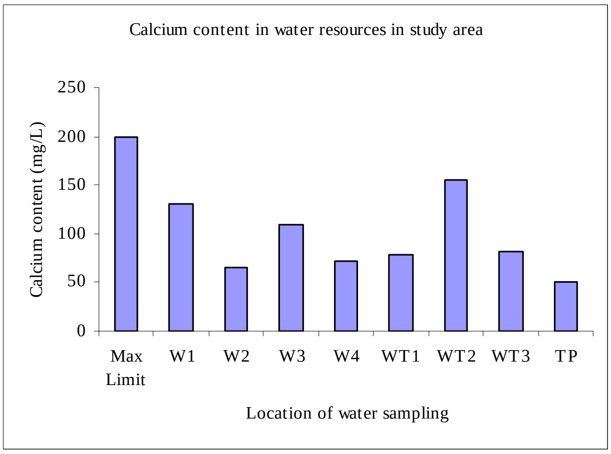

Fig.4: Comparison of calcium contents in water sampled from study area

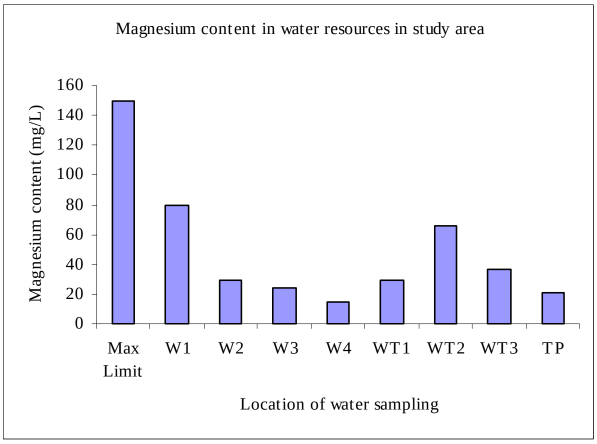

Fig.5: Comparison of magnesium content in water sampled from study area

The total solid (TS) contents (Fig.6), total suspended solid (TSS) contents (Fig.7) and total dissolved solid contents (TDS) contents (Fig.8) were influenced by percolated water at the locations near solid waste dumping sites as evidenced by the higher values. TS content were 2320 mg/L, 1875 mg/L, and 2705 mg/L at open well 1 (OW1), 3 (OW3) and tube well 2 (TW2) respectively which are higher than the permissible limit. Same pattern of variation in the TDS content was noticed at these locations. Slight impact was noticed in TSS contents water samples at open well 2 (OW2) and tube well 1 (TW1) which indicated relatively higher level of TSS contents.

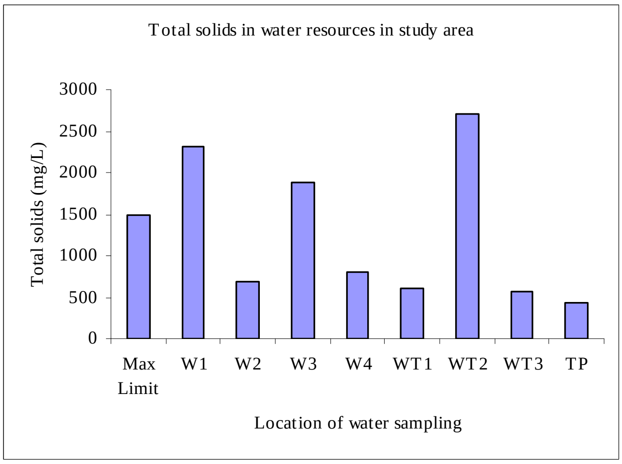

Fig.6: Comparison of total solids values of water sampled from study area

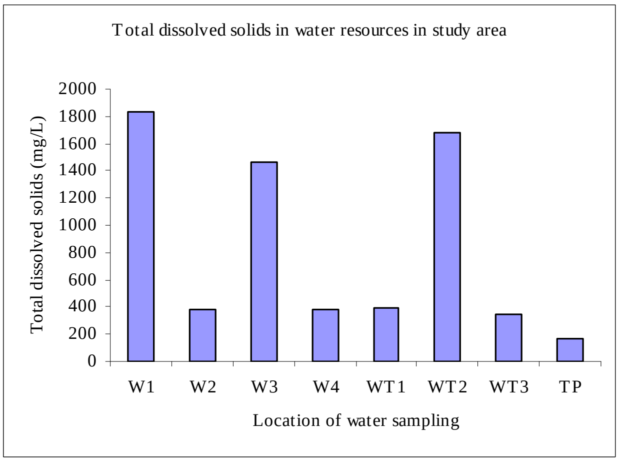

Fig.7: Comparison of total suspended solid content of water sampled from study area

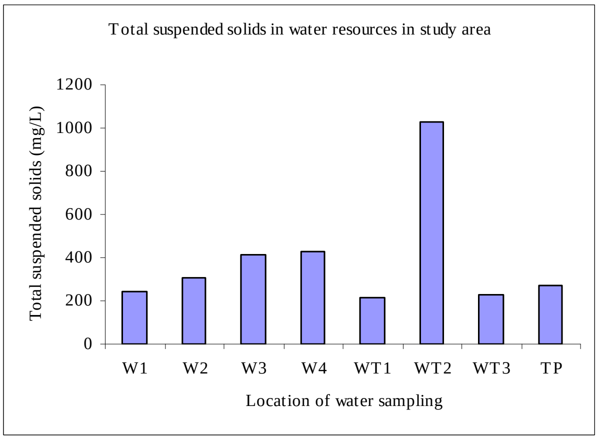

Fig.8: Comparison of total suspended solid content of water sampled from study area

The MPN results for three locations reached the extreme limit (MPN/100 ml $\geq$ 2400). The contaminated water samples showing positive results indicated the faucal contamination of ground water due seepage of domestic sewage or leachate from solid waste dumps. Higher level of MPN and SPC were recorded at open well 1(OW1), 3 (OW3) and tube well 2 TW2) which are likely contaminated by leachate percolation indicating that water was unfit for drinking purpose. The overall water quality from tube- wells was relatively better than that from open wells. The negative test result with respect to MPN from open well 4 (OW4) and tube well 2 (TW2) indicated no contamination and no MPN in water sample from WTP may be due to chlorination.

CONCLUSION

The overall results indicated that the water from the water sources located in the vicinity of solid waste dumping sites indicating pollution was unfit for drinking and the quality of water from open well, tube well and WTP located away from slid waste dumping sites was good indicating no pollution.

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