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# Physico-chemical and Bacteriological Assessment of Ground Water Quality of Makardhokla Mines, at Umrer (Nagpur, MS)

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**ABSTRACT**
Ground water is extensively being used as one of the major source of drinking water in the developing Countries. It is generally considered as the safest water source as far as pollution is concerned. However recent increase in unplanned urbanization without any adequate provision for disposal of the generated wastes and improper and incomplete treatment of waste by industries, agricultural practices and domestic users has increased the stress on water reservoirs of getting contaminated. Evaluation of ground water samples from Makardhokda Mines Housing Colony, Makardhokda was carried out for a period of one year (Oct-2010 to Sept-2011). Water samples were collected from five different sites of Makardhokda Mines within a range of 5Km area around the mines and analysed for physico-chemical characteristics (Temp, pH, Conductivity, Alkalinity, Chlorides, TDS, DO, COD, $SO_4$), bacteriological parameters (Total coliform count and fecal coliforms), and toxic metal (Ca, Mg, Mn, Fe, Arsenic). It was found in the present investigation that the pH of water samples was slightly alkaline. The total hardness of water samples was larger than desirable limit. The total alkalinity and COD was also larger the desirable limits. Bacteriological analysis of water samples collected from all the five sites showed the presence of fecal coliforms making it unfit for drinking purpose. It has been concluded from the above study that the ground water can be used only after suitable treatment.
Key words: Makardhokda, Mines, water quality, fecal coliforms, toxic metals.

## INTRODUCTION:

The provision of safe drinking water for the World's 1.3 billion deprived populations has become one of the topmost priorities of many governments in recent years. Water pollution and wasteful use of fresh water threaten development projects, agriculture, industry and even human existence and make water treatment essential in order to produce safe drinking water. Generally, some of the pertinent environmental issues pertaining to mining include erosion and sediment control, water conservation and balance, fugitive dust control, hydrocarbon or chemical spill control, waste streams or hazardous substances control, air pollution and mine tailings containment (Asamoah - Boateng Emmanuel Kofi, 2009). Mining activities include blasting which creates dust, increasing particulate matter in air and water, processing methods which produce toxic chemicals such as Arsenic, Cyanide, Sulphur dioxide, etc. Ground-water pollution can occur both directly and indirectly as a result of surface mining. Direct degradation can occur to ground water situated downhill or down gradient from a surface mine, by flow of contaminated drainage from the mine. This mine drainage can come from pits, ponds, or from rainfall infiltration and ground-water flow during mining and after reclamation. Ground-water pollution would result from the same toxic overburden and coal materials that cause surface water contamination (Henry Rauch).

## MATERIAL AND METHODS:

**Collection of samples**: water samples were collected for physico-chemical analysis from five different sites of the mining area. Samples were collected in plastic bottles of 2 lits capacity. The water temperature was measured by using mercury thermometer and pH was determined by using pH strip and pH pen, electrical conductivity by conductivity meter, total alkalinity was measured by titrametric method using methyl orange as the indicator. Field fixed dissolved oxygen samples were brought to the laboratory and analysed by azide modification of the Winkler's method APHA (2005); NEERI (1987) manual. The other water quality parameters were analysed as per the standard methods APHA (2005).

For Bacteriological analysis water samples were collected in sterile glass bottles, brought to the laboratory in ice box and were processes within 24 hours. The presence of coliforms and fecal coliforms were detected as per the APHA- AWWA (2005) standards.

**Sampling sites:**

Sample A- Bore well water from TSM colony of MKD mining area (1.5 Km from mines).

Sample B- Canal water, into which waste is discharged, that joined with Aam River (0.5 Km from MKD – I mine)

Sample C- Bore Well water of field area of MKD – II mine.

Sample D- Bore Well water from agricultural field near MKD-II ( 4 Km from MKD-II mine).

Sample E- TSM colony water sample (treated).

**RESULTS AND DISCUSSION:**

The physico-chemical characteristics are tabulated along with the standard values in Table-1. From these results, it is very clear that all the observed physico-chemical characteristics and Heavy metals were in desirable limit except Total Alkalinity, Total hardness, COD and Iron. These variables play a major role in variation of characteristics of ground water.

pH of all ground water sample were slightly alkaline but are in desirable limits, Table-1 and Graph 1.1. The total alkalinity and total hardness of all samples were beyond the permissible limit, Nawalakhe, 1995 (Table-1 and Graph 1.2 and 1.3). The COD values of all samples were beyond desirable limit, Ravanaiah, 2010(Table-1 and Graph 1.4). The Iron of all sample were beyond permissible limit, T. Nirmala, 2010 (Table-1 and Graph 1.5). The estimated ground water quality parameters have been compared with ISI standard (1983).

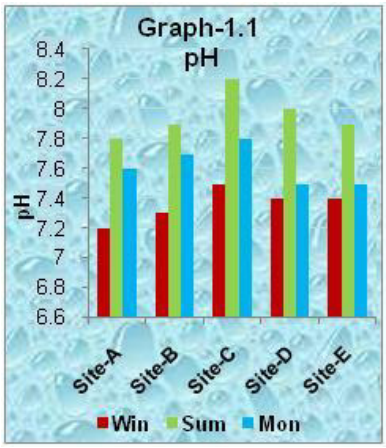
The samples collected from all the five sites contained fecal coliforms in all the three seasons. Coliform count was very high in rainy season followed by winter and summer season. Fecal coliforms were very high in number in Sample- B ( Summer, Winter, Monsoon ) and least in Sample –E (Summer-15, Winter- 25, Monsoon – 45) .

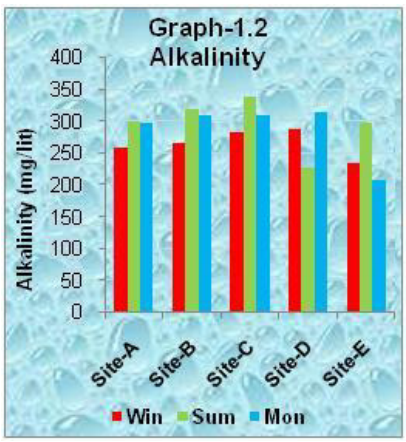
The results of the study revealed a high microbial indicator counts in all the water bodies suggesting high bacterial pollution of the waters. This was found to have come partly and indirectly from the Mines since the sources of the bacterial contamination could be traced to accidental leakages from the sewage treatment plants, settlements along the canal , leakage from highly polluted Aam river flowing through the mining area, poor sewage system coupled with poor sanitary conditions all contributed immeasurably to the high incidence of bacterial pollution of the ground water.

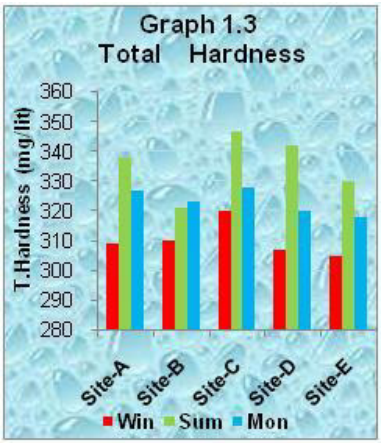
**Table 1. Quality of ground water from various sites in Makardhokda Mine, Tahsil - Umrer, Nagpur. (MS)**

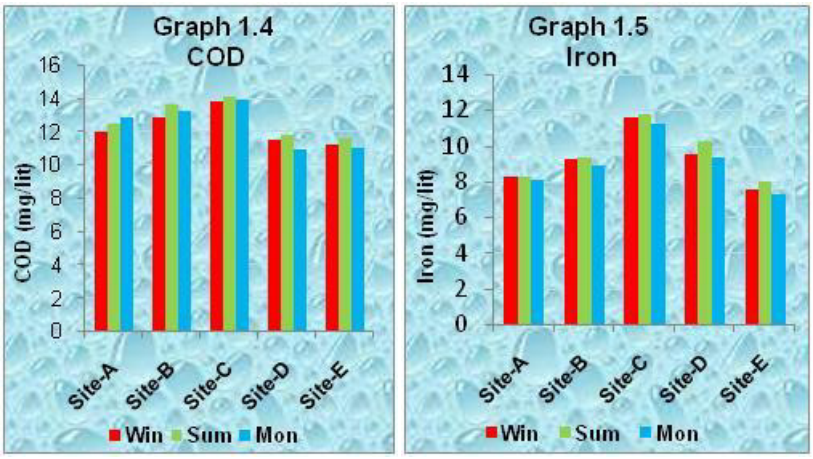
| Parameters | Season | Site-A | Site-B | Site-C | Site-D | Site-E | ISI Std.(1983) |
|---|---|---|---|---|---|---|---|
| pH | Winter | 7.2 | 7.3 | 7.5 | 7.4 | 7.4 | |
| | Summer | 7.8 | 7.9 | 8.2 | 8.0 | 7.9 | 6.0-9.0 |
| | Monsoon | 7.6 | 7.7 | 7.8 | 7.5 | 7.5 | |
| Alkalinity* | Winter | 258 | 265 | 283 | 289 | 235 | |
| | Summer | 300 | 320 | 340 | 328 | 298 | 200 |
| | Monsoon | 298 | 309 | 310 | 314 | 207 | |
| T. Hardness* | Winter | 309 | 310 | 320 | 307 | 305 | |
| | Summer | 338 | 321 | 347 | 342 | 330 | 300 |
| | Monsoon | 327 | 323 | 328 | 320 | 318 | |
| COD* | Winter | 12.0 | 12.8 | 13.8 | 11.5 | 11.2 | |
| | Summer | 12.5 | 13.6 | 14.1 | 11.8 | 11.6 | 10 |
| | Monsoon | 12.8 | 13.2 | 13.9 | 10.9 | 11.0 | |
| Iron* | Winter | 8.22 | 9.2 | 11.61 | 9.52 | 7.5 | |
| | Summer | 8.27 | 9.3 | 11.8 | 10.2 | 8.0 | 0.3 |
| | Monsoon | 8.1 | 8.9 | 11.2 | 9.3 | 7.3 | |

* - parameters in mg/lit






**Graph 1.1-1.5, showing the physico-chemical characteristics of the ground water at Sites A, B, C, D & E during Oct-2010 to Sept-2011.**

**CONCLUSION:**

If the mining effluents continue to be discharged at the present level, ground water pollution will continue to increase both in volume and concentration. Therefore, from the above mentioned facts, the ground water in the mining area of Makardhokda colony is no more on the safer side and proper remedial or alternative measures need to be taken immediately.

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