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Assessment of Iron content from ground water resources of Residential Zone of Aurangabad City

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Abstract:

Aurangabad, a developing urban center in Maharashtra's Marathwada region, relies predominantly on underground water resources for domestic and industrial water requirements due to rapid industrialization and urbanization. Groundwater samples were collected from C wards of Aurangabad city to assess iron content in residential areas from February 2007 to January 2008. In the present study, the iron content of the underground water resource in the majority of sampling sites exceeded the minimum threshold limit (0.3 mg/L).
Keywords: Water, Underground resource, sampling sites, Iron.

Introduction:

Groundwater and surface water constitute primary global water resources. The availability of clean and sufficient water is essential for the economic development and ecological stability of numerous nations. (Sener et al. 2017)
Water is a fundamental natural resource, essential for human requirements and a valuable national asset. Its quality is critical for human well-being, with applications in domestic, industrial, and agricultural sectors, as well as in inland fisheries (Patil, 2014).
Iron concentrations in drinking water are generally below 0.3 mg/L. Nonetheless, in some countries, levels may rise due to the use of iron-based coagulants in water treatment and the presence of cast iron, steel, and galvanized iron pipes in distribution systems. (WHO, 2003).
The consumption of water containing various anions and heavy metals poses significant health risks to humans, potentially resulting in deficiencies or toxicity due to excessive intake (Varol & Davraz, 2015).
Groundwater, in conjunction with surface water, is essential for human development, with approximately 1 billion people in Asia depending on it for domestic use.
(Foster, 1995).
It is estimated that approximately one third of the world's population uses groundwater for drinking purposes (UNEP, 1999).

Study Area:

This investigation selected Aurangabad city in the Marathwada region of Maharashtra for groundwater quality monitoring. Aurangabad, the regional headquarters of Marathwada, is situated at 19°53'59" N latitude and 75°20' E longitude. The study assessed groundwater quality in ward C, with five sampling sites chosen from this ward.

Sr No	Location of Sampling Sites	Ward	Sample Code	Sources	Water Use
1	Kailash Nagar		C1	HP	Drinking

2	Baijipura		C2	HP	Drinking
3	New Baijipura	C	C3	HP	Drinking
4	Roshan Gate		C4	HP	Drinking
5	Babar Colony		C5	HP	Drinking

Table 1. sampling sites with code and source

Plate 1. Selected sample sites from Aurangabad city

Methodology:

The five sampling sites were selected from ward C for the assessment of Iron Content of underground water resource. The collected underground water samples were preserved with by adding preservative agents and stored for few days. The preserved samples were digested with conc. HNO_3 and after restoring their quantity with glass double distilled water, the metal was determined by using Atomic Absorption Spectrophotometer.

The metal iron, was determined from the collected samples. The study of water quality monitoring was carried out during the two years period i. e from February 2007 to January 2008. The standard and widely accepted methods were used to determine the physico-chemical and microbiological parameters as described by (APHA, 1998; Trivedi and Goel, 1986; Maiti, 2004, Kaul and Gautam, 2002).

Results & Discussion:

Physical and chemical parameters, including metals like iron (Fe) and heavy metals, are crucial in determining water quality and its specific applications. This study measured iron levels, expressed in mg/L, in underground water from five sampling sites in ward C of Aurangabad city, with multiple readings taken to obtain average values. The iron content results are summarized in Table 1.1.

Sampling Sites	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN
C1	0.589	0.602	0.581	0.619	0.572	0.563	0.558	0.549	0.587	0.592	0.597	0.608
C2	0.676	0.688	0.669	0.697	0.661	0.655	0.648	0.642	0.672	0.676	0.682	0.68
C3	0.854	0.863	0.846	0.874	0.841	0.834	0.828	0.825	0.853	0.858	0.855	0.863
C4	1.047	1.059	1.041	1.072	1.035	1.029	1.025	1.019	1.049	1.045	1.053	1.059
C5	1.269	1.281	1.262	1.294	1.255	1.249	1.244	1.239	1.269	1.266	1.272	1.279
MEAN	**0.887**	**0.898**	**0.879**	**0.911**	**0.872**	**0.866**	**0.860**	**0.854**	**0.886**	**0.887**	**0.89**	**0.897**
±S.D	**0.276**	**0.276**	**0.277**	**0.276**	**0.277**	**0.278**	**0.279**	**0.280**	**0.278**	**0.274**	**0.275**	**0.275**

Table 2. Monthly variations in Iron (mg/L) during February 2007 to January 2008 of ward C.

The average minimum and maximum values of iron are 0.8548 mg/L and 0.9112 mg/L respectively during the period February 2007 to January 2008 of Ward C.

In present study the iron content of underground water resource of most of the sampling site has cross the minimum threshold limit (0.3 mg/L).

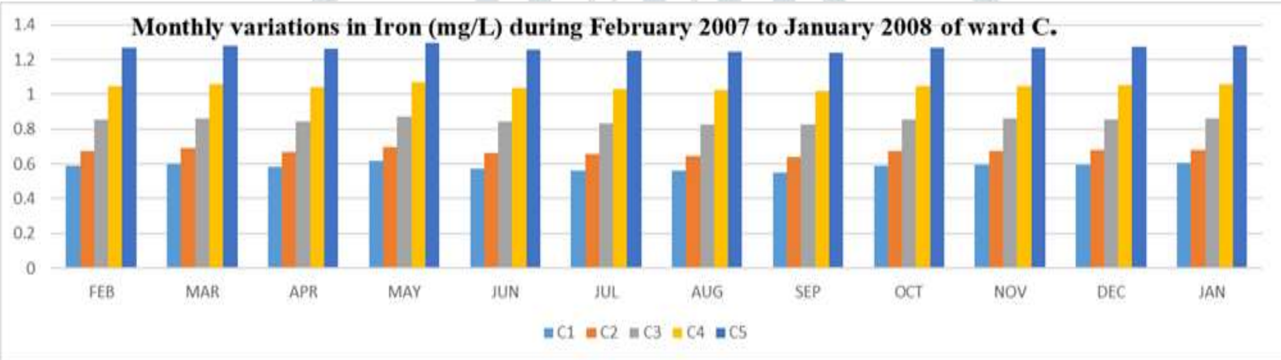

Fig 1.1

The primary sources of iron in groundwater are rock weathering and waste effluent discharge. Iron migrates adsorbed to suspended matter, as insoluble hydrated compounds, complexed with inorganic and organic ligands, and as hydrated ions. Dissolved carbon dioxide and pH influence the aqueous iron species in water. In groundwater, iron typically exists in two oxidation states: Ferrous (Fe2+) and Ferric (Fe3+). (CPCB,2008**).**

Kumar et al. (2007) investigated the groundwater of two cities in Punjab and reported average values of 1.46 mg/L and 0.15 mg/L in pre- and post-monsoon periods, respectively, in Patiala district, and 0.5 mg/L and 0.76 mg/L in pre- and post-monsoon periods, respectively, in Muktsar district.

Das (2003) examined Cuttack city's groundwater and found Fe concentrations ranging from 143 ppb in summer to 272 ppb during rainfall. Elevated Fe levels in aquifers likely stem from the interaction of oxidized Fe minerals with organic matter and the subsequent dissolution of Fe2CO3 at lower pH. Initially clear when drawn, this water soon turns cloudy and brown due to Fe(OH)3 precipitation, a common issue in parts of the study area.

Freeda Gnana Rani, (2006) studied under ground water of Thirumanur area, Tamil Nadu (India) and reported the higher iron content.

Rim-Rukeh et al. (2007) investigated the physicochemical properties of river and hand-dug well waters in Nigeria's oil-rich Niger Delta, reporting Fe concentrations of 6.07–15.71 mg/l in river water and 13.17–16.31 mg/l in hand-dug wells.

Conclusion: The metal study reveals that the iron content in most of the sampling site above the desirable limit of 0.3 mg/L. the elevated iron concentrations were observed at the majority of sampling locations. The presence of iron in the underground water resources can be primarily attributed to iron-bearing minerals within the geological formations. Furthermore, urban development activities, industrial machinery, motor vehicles, and ferrous roofing materials contribute to iron levels through oxidative processes.

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