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Assessment of Groundwater Quality Index of Mcc-B-Block Davanagere Karnataka

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Abstract
Analysis Of The Status Of Groundwater In Mcc-B-Block, Davanagere, Was Conducted To Evaluate Its Appropriateness For Drinking And Household Use. With Increasing Urbanisation And Potential Contamination Sources Such As Septic Tanks, Industrial Discharges, And Agricultural Activities, Regular Observation Of Water Quality Becomes Essential. Key Physicochemical Parameters—Such As Ph, Electrical Conductivity (Ec), Tds, And Hardness, Along With Primary Ions Including Calcium And Magnesium, And Chloride—Were Analysed. The Findings Were Compared Against Municipal Water Standards Based On The Bureau Of Indian Standards (Bis) Guidelines. While Most Parameters Fell Within Permissible Limits, Certain Samples Exhibited Elevated Tds And Hardness, Indicating Possible Contamination And The Necessity For Treatment Before Consumption. The Study Highlights The Significance Of Regular Monitoring And Sustainable Groundwater Management For The Protection Of Public Health And Environmental Security In The Mcc-B-Block Area.

1. Introduction

The Study Analyses The Quality Of Groundwater To Assess Its Appropriateness By Examining A Range Of Measured Physicochemical Parameters, Such As Ph And Ec, Td, Including Alkalinity, Total Hardness, Calcium, Magnesium, And Sodium, Potassium, Bicarbonates, Sulfate, Chlorides As Fluoride, Nitrate, And Copper, Manganese, Silver, Zinc, Iron, And Nickel. In The Study Area, The Water Quality Index Values Were Found To Range From 4.74 To 115.93. Indicating That, Overall, The Groundwater Is Generally Safe And Potable, Except In A Few Localised Areas Within Certain Blocks. According To The Hill-Piper Diagram, The Groundwater Chemistry In The Region Is Classified Into Sodium Chloride, Mixed Calcium-Magnesium-Chloride, And Calcium-Bicarbonate Types. The Presence Of Granite Containing Orthoclase Feldspar Contributes To The Formation Of Bicarbonate- And Chloride-Rich Groundwater Through Weathering Processes.The Findings Suggest That Groundwater In Some Parts Of The Study Area Shows Signs Of Quality Degradation, Requiring Treatment Prior To Use And Emphasising The Necessity To Safeguard Against Contamination Caused By Human Activities Ram Et Al., 2021)

This Study Aimed To Evaluate Groundwater For Human Consumption—Particularly As A Source Of Drinking Water—By Utilising The City's Wqi. Between June And August 2023, Samples Were Obtained

From 14 Wells And 6 Boreholes And Analysed For Both Physicochemical And Biological Parametersaccording To The Wqi, 14% Of The Samples Were Categorised As Extremely Low 35% As Good, And 5% As Excellent. Overall, The Study Concluded That The Underground Water In The Region Is Generally Unfit For Human Drinking Without Prior Treatment. As A Result, It Is Recommended That Groundwater Undergo Proper Treatment Either At The Household Level Or At Communal Storage Facilities Before Being Distributed For Use. Additionally, The Study Emphasises The Necessity Of Health Awareness Programs Focused On Improved Sanitation Practices And Behavioural Change, Particularly In The Management Of Faecal Sludge, To Mitigate Contamination Risks In The Region. (Sophia Et Al. 2025)

2. Materials And Methodology

2.1.Study Area

The Specific "Mcc-B Block, Davanagere" Is Not Clearly Delineated As An Independent Groundwater Study Area In The Available Literature; Groundwater Samples Were Evaluated In The Environmental Engineering Lab At Ubdt College Of Davanagere. The Water Samples Were Carried Out Using Established Procedures That Included Physic-Chemical Parameters Like Tds (Total Amount Of Dissolved Solids), Electrical Conductivity, Alkalinity, Acidity, Ph, Total Dissolved Solids, Magnesium Hardness, Calcium Hardness, Chloride, And Oxygen Dissolved In The Water. The Samples Were Collected In Plastic Bottles Using The Standard Procedure For Grab Samples In Accordance With Standard Methods. Samples Had Been Collected In Pre-Wiped And Rinsed Bottles Of One Or Two Litres In Potential With Vital Pre-Warning And Transferred To The Laboratory For Evaluation Of Physico-Chemical Parameters Analysis Of Samples.

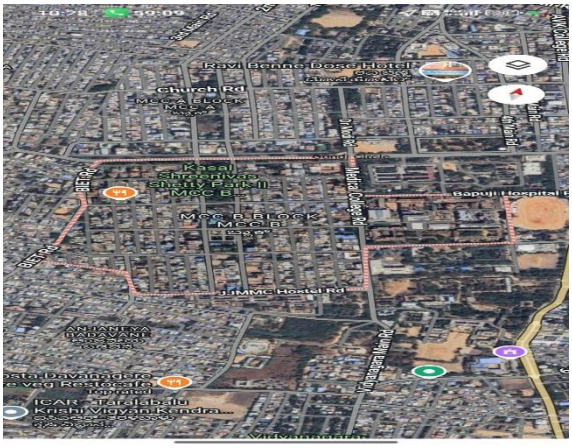

Fig. 1: Sample Collection Mcc- B-Block Davanagere.

2.2 Key Features

- Location: Davanagere
- Latitude: 14°28' N Latitude And 602.5 Metres (1,977 Ft) Above Sea Level.
- Longitude: 75°59' Longitude
- Area: Mcc-B-Block Davanagere
- Population: 2011(434,971) 2025(633,000). Based On The 2011 Census Data, The Child Sex Ratio In Davanagere District Was 948 Girls Per 1,000 Boys, Reflecting A Marginal Rise From 946 Girls

Per 1,000 Boys Reported In The 2001 Census. This Information Relates To The District's Religious Demographic Profile.

- Density: 329 People Per Square Kilometre. Pipe Of Water Supply: 20mm To 315mm
- Area: 1020 Sq/Km
- Annual Rainfall: 620 To 920mm
- Sea Level: At A Height Of 602.5 Metres (1,977 Ft), Measured From Sea Level

3. Results And Discussion

3.1. Physicochemical Parameters

Water Quality And The Concentration Of The Majority Of Qualities Are Essential For The Reuse And Multipurpose Use Of Water Resources, Including Drinking And Agriculture. Therefore, The Parameters' Values Are Taken Into Account To Determine The Parameters Of Groundwater Quality And To Provide Various Groundwater Quality Metrics.

Table:1 Physicochemical Of Groundwater Quality Parameters

Parameters	Min	Max	Mean	Sd
Ph	7	8.5	7.72	0.3191
Alkalinity	202	490	307.00	93.909
Electric Conductivity	410	1500	616.00	208.85
Tds	244	715	499.72	106.18
Chloride	59.98	550	175.26	146.40
Do	4	5.6	4.64	0.4781
Total Hardness	200	450	275	51.808
Magnesium Hardness	61	330	111.51	51.432
Calcium Hardness	0.3	214	18.87	37.074

7.9

A Determination Physic-Chemical Examination Of 50 Borewell Samples Was Uses For Assessing Groundwater Quality Of The Mcc-A Block In Davanagere. The Report Provides Significant New Details Regarding The Area's Groundwater's Appropriateness For Household And Drinking Purposes. According

To The Examination, From All The Samples, Ph Values Fell Between 6.5 And 8.5, Which Is The Bis Permissible Range, Indicating Neutral To Slightly Alkaline Circumstances. In General, Electrical Conductivity (Ec), Total Dissolved Solids (Tds), And Alkalinity Were Determined Within Allowable Limits, Indicating Indicating The Study Area's Groundwater Is Mostly Suitable For Irrigation And Human Use.

The Wqi Serves As An Effective Approach For Evaluating Overall Water Quality, As It Combines Multiple Parameters And Compares Them With The Standard Limits Prescribed By Bis To Ensure Public Health Protection. By Assigning Specific Weightage To Each Parameter, The Consolidates Multifaceted Water Quality Information Into A Single Numerical A Value Representing The Purity Of Water. The Index Delivers A Clear, Unitless Value, Making It Easier To Report Water Quality To The Public And Officials. The Idea Of Water Quality Indices Was Initially Proposed By Horton In 1965, Who Suggested Using Eight Essential Parameters To Assess Water Systems. During The Same Year, Brown And Co-Researchers, In Collaboration With The National Sanitation Foundation (Usa), Refined This Approach, Resulting In The Creation Of The (Nsfwqi) Provides A Comprehensive Assessment Of Water Quality. Moreover, It Helps Pinpoint Sources Of Pollution, Enabling The Adoption Of Suitable And Effective Remediation Strategies

Methodology Implemented In Calculating The Wqi: - The Nsfwqi Method Was Employed In This Study, Which Involves The Following Five Steps, As Outlined Below Step 1: Collection Of The Various Parameters Of Physicochemical Nature Applied To Analyze Water Quality. Step 2: The Mathematical Expression Applied For Assessing The Wqi Is Given As. $\boldsymbol{WQI} = \square\boldsymbol{wi} * \boldsymbol{qi}\ \boldsymbol{n}\ \boldsymbol{i}\widehat{\ }\boldsymbol{0}$ Where We = Unit Weightage Of The Parameter, Qi = Sub-Index Of The Parameter. Step 3: Calculation Of The Unit Weightage Of The Parameter (We) By Using An Expression $Wi=\boldsymbol{K}/\boldsymbol{Si}$ Where K Is The Proportionality Constant, Si Is The Recommended Value Of The Parameter. Step 4: Calculation Of The Sub-Index Of The Parameter By Using An Expression Qi=100*Vi/Si Where Vi = Monitored Value Of The Parameter. Si Is The Recommended Value Of The Parameter. Step 5: By Substituting The Relevant Values Into The Equation, The Wqi Of Each Sample Was Calculated. The Resulting Wqi The Measured Values Were Subsequently Compared To The Water Quality Range Standards Provided By The Wawqi, Enabling An Assessment Of The Sample's Quality, As Summarized In The Table Below.

Table 4.2: Water Quality Range Standard Provided By Wawqi

Wqi	**Water Type**
0-25	Excellent Water
26-50	Good Water
51-75	Poor Water
76-100	Very Poor Water
Above 100	The Water Is Unsuitable For Drinking Purposes.

Table 4.2 Analysis Of Wqi Analysis

Sample Number	**Wqi Value**	**Analysis**

1	57.41	Poor
2	55.91	Poor
3	50.82	Poor
4	43.65	Good
5	48.49	Good
6	46.07	Good
7	55.02	Poor
8	44.40	Good
9	60.78	Very Poor
10	33.90	Excellent
11	57.0	Poor
12	55.09	Poor
13	50.10	Poor
14	42.2	Good
15	60.14	Very Poor
16	62.08	Very Poor
17	36.87	Very Good
18	48.80	Good
19	55.28	Very Poor
20	58.60	Very Poor
21	54.45	Poor
22	48.00	Good
23	43.47	Good
24	44.01	Good
25	58.25	Poor
26	43.43	Good
27	48.57	Good
28	49.60	Good
29	49.85	Good
30	61.60	Poor
31	50.51	Good
32	58.40	Poor

33	52.8	Poor
34	64.55	Very Poor
35	62.40	Very Poor
36	41.59	Good
37	33.90	Excellent
38	41.75	Good
39	47.80	Good
40	50.09	Good
41	46.18	Good
42	49.10	Good
43	49.73	Good
44	49.30	Good
45	49.50	Good
46	56.15	Poor
47	49.45	Good
48	50.80	Good
49	48.89	Good
50	50.00	Good

The Wqi, Or Water Quality Index, Is A Numerical Tool That Evaluates The Overall Status Of Water By Considering Multiple Physicochemical Parameters. It Condenses Detailed Water Quality Information Into A Single Score, Indicating How The Water Is Deemed Appropriate For Both Human Consumption And Ecosystem Maintenancebased On The Wqi, Based On The Evaluated Parameters, Water Is Classified Into Quality Classes Such As Excellent, Good, Poor, Or Very Poor Extent Of Contamination, And Pollutant Concentrations. Typically, A Higher Wqi Value Indicates Poorer Water Quality. Table 4.2 Shows The Wqi Scores Of 60 Samples. Evaluating These Samples And Their Classifications Enables Identification Of Areas With Deteriorating Water Quality And Supports The Development Of Effective Management And Treatment Strategies

Conclusion

Further, The Wqi Assessment Corroborated These Results. Among The Fifty Samples Examined, 60% Fell Into The ‘Good’ Category, 30% Were Classified As ‘Poor,’ 12% As ‘Very Poor,’ 5% As ‘Excellent.’ None Of The Samples Classified As ‘Unsuitable For Drinking.’ Hese Results Suggest That, Although A Large Portion Of The Water. Samples Are Fit For Use; A Significant Portion Still Requires Treatment And Careful Management To Ensure Safe Consumption. Overall, The Results Indicate That The Groundwater From The Mcc-B Block Area Is Generally Fit For Residential Use; Nevertheless, Specific

Hardness And Mineral Enrichment Problems Necessitate The Employment Of Acceptable Treatment Techniques, Such As Filtration And Softening. The Study Also Highlights The Significance Of Ongoing Monitoring And Sustainable Groundwater Management Techniques In Order To Guarantee The Long-Term Supply Of Safe And Clean Water, Safeguard Public Health, And Reduce The Likelihood Of Further Pollution.

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