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Water Quality Status of Jalna District Of Marathwada Region, Maharashtra State: A Review

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Abstract- The quality of water is characterized by a range of physical, chemical and biological parameters, which arise from a variety of natural and human influences. Day-by-day the quality of water is being badly affected by diverse causes like sewage contamination from urban, industrial pollution and over use of pesticides and fertilizers in the farm. Since water is the prime input for human being and other living animals, hygiene becomes critical problems. Ground as well as surface water is main sources of drinking water. This article attempts to review the quality of surface and ground water in Jalna district and its effects on human health. The overall surface and ground water quality of district was poor, which could be due to high TDS, F, SO_4, NO_3 and E-coli contamination levels exceeding the permissible limit. The water quality of Jalna district showed poor water quality at Ambad and Parthur talukas, whereas, Jafrabad and Bhokardan ground water quality found to be unsuitable for drinking. Significant concentration of TDS, TH, Ca, Mg and nitrate affecting the overall water quality could be due to the overuse of fertilizers, geological and soil texture of this region.

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Keywords: Water quality, Drinking water, Jalna District, Maharashtra state.

1. INTRODUCTION

Water is 'life'. It is one of the fundamental needs on the globe. Water is essential for variety of purposes to human beings as well as to plants and animals. Its many uses include drinking and other domestic uses, irrigation, power generation, transportation, industrial cooling, fishing, mining and recreational uses etc. Water in the only natural resource which is essential to all parts of human development includes agricultural, industrial development, cultural and religious values implanted in civilization. 'Water Quality' term is generally used to express the physical, chemical or biological state of water. This in turn, may be related to the suitability of water for a particular use or purpose. The quality of water is characterized by a range of physical, chemical and biological parameters, which arise from a variety of natural and human influences. Normally field or laboratory analysis of water is carried out for determination of its quality. Generally, water is never unpolluted in a chemical sense. It always encompasses impurities various kinds of dissolved as well as suspended. These include dissolved gases like CO_2, H_2S, NH_3 and N_2, dissolved minerals Ca, Mg and Na salts, suspended matter, clay, silt, sand and even microbes. The natural impurities in water are in very low concentration, which are derived from atmosphere and soil. These impurities do not pollute water and the same is potable. Due to modernization, quality of water is being severely affected by various sources like sewage contamination from urban, industrial pollution and over use of pesticides and fertilizers in the farm. Since water is the prime input for human being and other living animals, therefore, hygiene becomes critical problems. Ground as well as surface water is main sources of drinking water. This article attempts to review the quality of surface and ground water in Jalna district and its effects on human health.

2. STUDY AREA

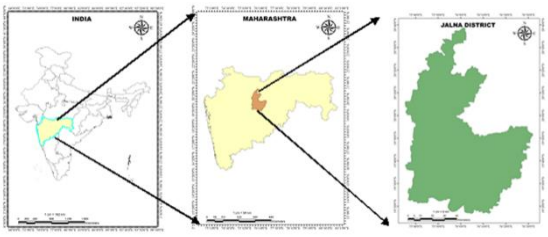
Jalna district is situated at the center of the Maharashtra state, hence the Union Ministry of Communication has established satellite monitoring station near Jalna city. This makes it suitable to communicates with the other satellites in space. It is bounded by North latitude 19° 16 and 20° 32' and East longitude 75°42'00" and 76°30'45". It falls in parts of Survey of India Toposheet No. 46P, 47 M, 55 D and 56 A. (CGWB, 2010).

According to Census 2011, the total area of the district is 7718 sq. Km., it is 2.51% as compared to area of Maharashtra state. About 1.32% of the total area i.e. 102.0 sq.km is urban area and 98.68% i.e 7616 sq. Km is rural area. There are eight talukas Bhokardan,

Jafrabad, Jalna, Badnapur, Ambad, Ghansawangi, Partur, Mantha and four subdivisions for eight Tehsil in Jalna district for administrative suitability.

As per Census 2011, there are 971 villages in the district, out of which 963 villages and 8 desert villages are located. There are 806 separate Gram Panchayats and 157 Gram Panchayats in the district. The district headquarter is located at Jalna and there are district collector office and district level offices of various departments located at Jalna.

3. LOCATION MAP OF JALNA DISTRICT

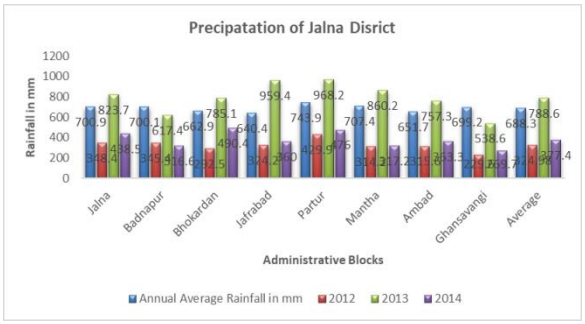


4. CLIMATE AND RAINFALL

As per the report of CGWB, 2010, district has dry and tropical climate with very hot summer and mid-winter with humid SW monsoon season of moderate rainfall. The climate can be divided into three main seasons viz; hot to warm humid monsoon season from June to September whereas cool dry winter season from October to February and hot dry summer season from March to June. Temperature during rainy season ranges from 21°C to 30°C. In winter season temperature fall appreciably and range from 10°C to 25°C. In nights temperature range is 20°C to 25°C with privilege of cool breeze. The air is generally dry over the district except during the south west monsoon when the relative humidity is high. The summer months are the driest when the relative humidity is generally between 20°C and 25% in the afternoon. Winds are generally light to moderate with increase in speed during the later half of the hot season and in monsoon season. The winds blow predominantly from directions between west and north during the hot season. They are mostly from directions between southwest and northwest during the southwest monsoon season. The rainfall record shows that the district has two regions on the rainfall pattern. The first includes Bhokardan, Jafrabad and Jalna talukas with rainfall of about 700 mm favorable for Khariff cropping. The second region covers Ambad and Partur talukas with rainfall of about 800 mm or more favorable for rabi cropping. Precipitation is not even in all parts of the district. The area of moderate rainfall of 625 to 700mm is Bhokardan and Jafrabad talukas

The precipitation for the period 2012-2014 is given in Table-1. The average annual rainfall in the area is 725.80mm. About 83% of the rainfall occurs during June to September and July is the rainiest month. The average annual rainfall in the district ranges from about 664 mm (Bhokardan)to about 837 mm (Mantha) (CGWB, 2010).

Figure 1: Jalna District Annual precipitation status



Source: Waseem Ashfaque et al., (2015)

5. GEOMORPHOLOGY AND SOIL TYPES

The North-Western part of the district is included of the eastern hills of the Ajanta Plateau. The satmala hill ranges (943 m above msl) pitches an offshoot in south esastern direction through Jafrabad taluka which forms the western edge of the Buldhana plateau. Eastern side-shoot of the Ajanta or Satmala hill ranges includes plane topped hills form splits between Purna and Girija rivers and between Girja and Dudhna rivers. The southeastern offshoot of Ellora hills comprising a series of dissected flat-topped hills reach up to Ambad town. Apart from these, mountainous areas are occurring in northern and western portions of Jafrabad, Bhokardan and Ambad talukas. Most of the southern and central parts of the district comprise undulating plains. Elevations of the hilly regions range from 600to 900 m above msl and of the plains from 450 to 600 m above msl. Generally ground slope in the district is towards east and southeast. Plains along the banks of Godavari and Dudhna rivers in Ambad and Partur talukas range in elevation from150 to 350 m above msl (CGWB, 2010). The soils of the district are black with considerable variation in texture and depth. They are light, medium and heavy soils. The soils laterally with river banks particularly in Ambad and Partur blocks are deep black and quite fertile. The soils in northern parts of the district i.e. in Jalna, Bhokardan and Jaffrabad blocks are coarser.

6. GROUND WATER STATUS

6.1 Hydrogeology

Groundwater occurrence and movement in the area is influenced by its rock formations. Groundwater

potentially depends upon porosity and permeability (both primary and secondary) of rock formations. Jalna district is situated under by basaltic lava flows and alluvium only (Waseem Ashfaque et al., 2015).

6.2 Ground Water Quality

Central Ground Water Board observed the ground water quality of the district through its National Hydrograph Network Stations (NHNS), which primarily includes of the excavated wells representing shallow aquifer. The objective of monitoring is to verify overall scenario of the ground water quality in the district., CGWB carried out the ground water quality monitoring of 16 NHNS during the year 2007. The chemical analysis results showed that, the ground water in the district is alkaline in nature, while the EC and TDS values show that the ground water in the area is mineralized to medium extent. The concentrations of the major ions indicate that among the cations, the concentration of magnesium ion is highest followed by sodium and calcium while among anions, the concentration of chloride ion is highest followed by bicarbonate and sulphate ions. The results also revealed that, the nitrate concentration in the ground water significantly observed (CGWB, 2010). The water quality survey was conducted by Keshab Das (2006) reported that, out of the 26 districts under the SRP (Swajaldhara programme), 18 are facing problems related to groundwater quantity and quality including Jalna District.

6.3 Suitability of Ground Water for Drinking Purpose

The ground water quality suitability for drinking purpose was determined considering the effects of various chemical constituents on water quality. Though many ions are very essential for the growth of human, but when present in excess, have an adverse effect on human body. The standards proposed by the Bureau of Indian Standards (IS 10500: 2012) for drinking water were used to decide the suitability of ground water.

Table 1: Classification of Ground Water Samples based on BIS Drinking Water Standards (IS-10500-91, Revised 2012)

Parameter	Desired Limit (DL)	Maximum Permissible Limit (MPL)	% of Samples with conc. Less than DL	% Samples with conc. In between than DL and MPL	% Samples with conc. More than MPL
TDS	500	2000	25	68.75	6.25
TH	300	600	25	56.25	18.75
Ca	75	200	37.5	50	12.5
Mg	30	100	12.5	81.25	6.25
Cl	250	1000	68.75	25	6.25
SO_4	200	400	68.75	12.5	18.75
NO_3	45	No relaxation	25	--	75
F	1.0	1.5	87.5	6.25	6.25

The results of Table-1reveals that,25% samples showed concentration less than desire limit for Total Dissolved Solids, Total Hardness and Nitrate whereas 1% and 3% samples exhibit concentration above maximum permissible limit for Total Dissolved Solids and Total Hardness respectively. However, 75% of samples were found with concentration above maximum permissible limit for nitrate. The habitat wise testing report of NRDWP for the year 2016-17 also observed nitrate level more than 190 mg/l at various locations of Bhokardan taluka of Jalna district which signifying high impact of human activity including washing, bathing and farming near to the drinking water sources, causing nitrate contamination in the area. Therefore, it can be resolved that the ground water quality is mostly affected by nitrate contamination. It is also significantly noted that, in the 100% samples fluoride was detected.

6.4 Ground Water Related Problems

The major part of the district was depicting reducing ground water level trends mainly in northern, southern and eastern parts of the district including almost entire Bhokardan, Jafrabad, Ambad, and Partur talukas and major portion of Jalna taluka in central part of the district. Thus, the future water conservation and artificial recharge constructions needs to be prioritized in these areas. Ground water quality is badly affected at many places due to high concentration of some parameters especially nitrate. The current EPA standard of 10 ppm is based on a 45 year old survey of methemoglobinemia in infants. In the world, there were many cases of methemoglobinemia reported which caused due to contamination with nitrate at less than 10 ppm in drinking water (Sattelmacher 1964; Simon 1962). As per Bureau of Indian Standards (IS 10500: 2012) maximum permissible limit for nitrate in drinking water is 45 mg/L and considering its significant role in quality of water there in no relaxation. Adequate sanitary protection to the wells may be provided to control the nitrate contamination. As TDS were absorbed above MPL in few samples in the area. These ions in water is desired for aquatic life up to certain level. The Total Dissolved Solids concentrations can be injurious to health as it determine density which controls the flow of water into and out of an organism's cells (Mitchell and Stapp, 1992).

Fluoride pollution in the ground water indicate consideration towards the treatment of water prior to use it for domestic purpose. Fluoride contamination causes health problems in people living in more than 25 nations around the world. The essential concentration of Fluoride at least 0.6 mg/l is required for human consumption as it will help to have stronger teeth and bones. As per BIS (Drinking Water-Specification 2012) acceptable limit for fluoride is 1 mg/L whereas 1.5 mg/L is maximum permissible limit in absence of alternate source. The drinking of water

contaminated with fluoride concentration above 1.5 mg/l results in acute to chronic dental fluorosis due to it tooth become colored from yellow to brown. Skeletal fluorosis which is resulted into weakness and bending of the bones due to long term consumption of water containing high amount of fluoride. The sources of Fluoride concentration in groundwater is natural or anthropogenic causes or a blend of both. Natural sources are related to the geological circumstances of an area (Karthikeyan & Lakshmanan, 2011).

7. SURFACE WATER

7.1 River Basins in Jalna

The district is well drained by river systems, which are dendritic type and have matured valleys. There are two principal drainage systems viz; (1) Godavari River and (2) the Purna and Dudhna rivers. The Godavari River forms the entire southern boundary of the district in Ambad and Partur talukas. It is one of the most important river of Deccan plateau and entire Jalna district falls in its great basin. The direct tributaries of the river are Shivbhadra, Yellohadrs, Galhati, Musa and Jui rivers. All these tributaries rise from the Ajanta and Ellora plateau and flow south and eastwards to join the Godavari River. While most of the smaller streams dry up in summer, the major rivers are perennial. Purna River rise from near Mehun about 8 km NE of Satmala hills and at a height of about 725 m amsl. It is most important river after Godavari and drains entire area of Jafrabad, Bhokardan and parts of Jalna talukas. Its tributaries are Charna, Khelna, Jui, Dhamna, Anjan, Girja, Jivrakha and Dudhna rivers (CGWB, 2010).

7.2 Surface Water Quality

The water quality of Jalna district analyzed by Ismail H and Syed Abed. (2017) revealed that water samples collected from different sites of Jalna area does not comply with BIS prescribed standards. The result significantly showed that, contamination of E. Coli, nitrates and residual chlorine therefore it is essential to check pollution level prior to use it for domestic and drinking purposes and significant degree of purification is required before being used. Hiwale, et al., (2017) investigated that, metal ion concentration was present at the levels which will be safe for humans and ground water sources were found healthy for drinking and other purpose. As per the Taluka-wise investigation by Dhere Mahadev. (2015) quality of provided drinking water to the sample beneficiary families shows that out of 28 surveyed beneficiary families of Bhokardan taluka, 07 families received very good quality of water and 11 families received bad whereas 08 and 2 families received bad and very bad quality of water respectively.

The study conducted by Salve. (2014) revealed that, during the year 2012 there was shortage rainfall in the Jalna District due to which the static water level in the area has been declined by 450 m. due to which the water supply of area has been interrupted. The surface storage in 7 medium irrigation projects and 57 minor irrigation project is below seal level or almost dry after rainy season which subsequently affect yield of source for Pipe water supply schemes of the villages. Ultimately there was no availability of Groundwater as well as surface water for mitigation of drinking water scarcity of the Jalna district. All the sources in district area become non-operational due to inadequate water availability.

Bodkhe Naresh, (2014), recommended that, major strategies for meeting water requirement include increased run off capture by higher surface water storage and consequently greater ground water potential, reduction in agricultural water requirement by use of micro irrigation techniques and recycling domestic and industrial water. Every municipal corporation in Jalna district should have a sewage treatment plant for recycling domestic water. Jalna city alone generates 13.2 MLD waste water per day. Further, there are no underground drainage schemes for the four MCs in the district. Treated water can be reutilized for irrigation or industrial purposes. Similarly, every MIDC industrial estate must have wastewater treatment plant. For rural habitations, use of soak pits must be promoted. The local community should handle regular operation and maintenance of drinking water schemes already completed. For this, regular collection of funds locally called as panipatti should be done through gram panchayats. Further suggested that, in order to sustain the existing drinking water sources, villages/gram panchayats should do rain water harvesting.

The most significant part of the Jalna district is that about 80% of Geographical area is under agricultural use. The 75% area is under Kharif crop and about 40% of land is under Rabbi crop. Agricultural activities are extensive along the Dudhana, Godavari, Purna rivers and their tributaries covering major parts of Bhokardan, Jalna and Ambad tashils. Since all these tahsils are located in the plains of these rivers, the land in this part is favorable for agricultural activities (JDDMP, 2012).

8. CONCLUSION

As per water quality survey conducted by Ground Water Survey and Development Agency (GSDA), Central Ground Water Board (CGWB) and MPCB for identification of major contaminants and validation of suitability of ground water for domestic purpose. All 8 talukas covering 22 villages were monitored by CGWB. The descriptive statistics of ground water monitoring carried out in the villages and calculated water quality index of ground water for Jalna district. The above study reveals that, the overall surface and ground water quality of all taluka was found to be poor, which could be due to high TDS, F, SO_4, NO_3

and E-coli contamination levels exceeded the permissible limit. The water quality of Jalna district showed poor water quality at Ambad and Parthur talukas, whereas, Jafrabad and Bhokardan ground water quality found to be unsuitable for drinking. Significant concentration of TDS, TH, Ca, Mg and nitrate affecting the overall water quality could be due to the overuse of fertilizers, and geological and soil texture of this region.

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