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THE PROBLEM OF HARDNESS IN GROUND WATER OF DEOLI TEHSIL (TONK DISTRICT) RAJASTHAN

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ABSTRACT

Hardness is an important water quality parameter because excess hardness is not suitable for drinking and other purpose. Hard water produces serious health problems like- urolithosis, cardiovascular disorder, kidney problems, anencephaly and cancer.

Key words: Hardness, Health problem, Deoli Tehsil.

INTRODUCTION

Water hardness is a measure of the cations (cations = ions which bear positive electron charges) dissolved in the water and is therefore, related to dissolved solids. The more cations dissolved in the water the "harder" the water. The most common cations of this type are calcium and magnesium. Iron, strontium, and manganese may also contribute, but they are seldom present in appreciable amounts. Hardness[1] is usually reported as an equivalent amount of calcium carbonate ($CaCO_3$).

The main natural sources of hardness in water are dissolved polyvalent metallic ions from sedimentary rocks[2], seepage and run off from soil. Calcium and magnesium, the two main ions are present in many sedimentary rocks, the most common being limestone and chalk. As mentioned above, a minor contribution to the total hardness of the water is also made by other polyvalent ions, e.g. aluminium, barium, iron, manganese and zinc. The degree of corrosion and solubilization of metals occur also depend on the pH, alkalinity and dissolve oxygen concentration.

Water hardness is the traditional measure of the capacity of water to react with soap. It is not caused by a single substance but a variety of dissolved polyvalent metallic ions, predominantly calcium and magnesium cations. Although other cations of barium, zinc also contribute. In general hard water originates in areas where top soil is thick and lime stone formation are present. The main natural sources of hardness in water are dissolved polyvalent metallic ions from sedimentary rocks, seepage and run off from soils. Calcium and magnesium, the two principal ions are present in many sedimentary rocks, the most common

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being lime stone and chalk. Hardness levels above 500 mg/L (WHO[3]) are generally considered to be aesthetically unacceptable.

According to past studies, an inverse relationship between the hardness of drinking water and cardiovascular disease has been reported by Smith and Crombie[4] and other some diseases like anencephaly[5] and cancer[6] also caused by hardness of water.

EXPERIMENTAL

In the present study 130 water samples in clean Polyethylene bottles from different sources viz. hand pumps, open wells, tube wells and PHED water supply were taken and preserved according to standard methods. A titrimetric (complexometric) method prescribed by American Public Health Association (APHA[7]) was followed for estimation.

RESULTS AND DISCUSSION

Calcium hardness: Calcium hardness (Ca-H) ranged from 50 to 480 mg/L. Minimum Ca-H was observed from Inderpura Village wherea, as maximum Ca-H was reported from Badoli Villages (Fig. 1). Ca-H was found to be within the limit in 48% villages, lower in 10% villages, whereas 42% Villages are higher (Table 2 and Fig. 3).

Table 1: Drinking water standards prescribed by different agencies

Parameter		BIS	WHO
Ca Hardness	Desirable Limit	75	75
	Max. per limit	200	200
Mg Hardness	Desirable Limit	30	30
	Max. per limit	150	150

All value are in mg/L BIS[8]- Bureau of Indian Standard; ICMR[9] – Indian Council of Medical Research; WHO[3] – World Health Organisation

Table 2: Showing permissible limit and percentage of villages of Deoli Tehsil

Parameters	Permissible limit	Villages %		
		Below	**Optimum**	**Higher**
Ca-H	75-200 mg/L	10%	48%	42%
Mg-H	30-150 mg/L	-	92%	8%
TH	100-500 mg/L	0.76%	95.38%	3.84%

Calcium hardness (Ca-H), Magnesium hardness (Mg-H), Total hardness (TH)

Magnesium hardness: Magnesium hardness (Mg-H) assessed from 30 to 250 mg/L. Minimum Mg-H was traced from Rajkot Village wherea, maximum Mg-H was reported from Mugalana Village (Fig. 2). Mg-H was within permissible limit in 92% Villages, while remaining 8% contained Mg-H higher than limit (Table 2 and Fig. 4)

Total hardness: Total hardness (TH) is characteristics by contents of calcium and magnesium salts. Ca-H and Mg-H combine to form total hardness. Total hardness (TH) varied from 90 to 600 mg/L. WHO

recommended (100-500 mg/L) as safe permissible limit for hardness. In ground water, hardness is mainly due to carbonates, bicarbonates, sulphates and chlorides of Ca and Mg. Minimum TH was observed from Inderpura Villages wherea, maximum TH was reported from Badoli Villages (Fig. 5). Total hardness was higher in 3.84% villages, lower in 0.76% villages, whereas 95.38% samples contained TH within optimum limit (Table 2 and Fig. 6). The property of water which prevents the lather formation with soap and increases the boiling point of water.

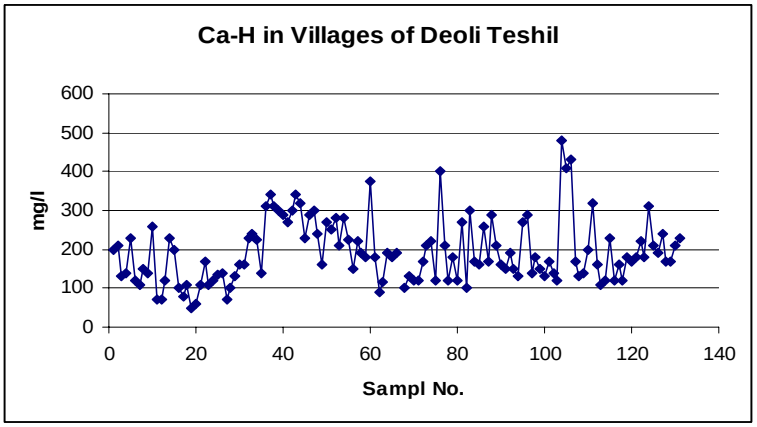

Fig. 1

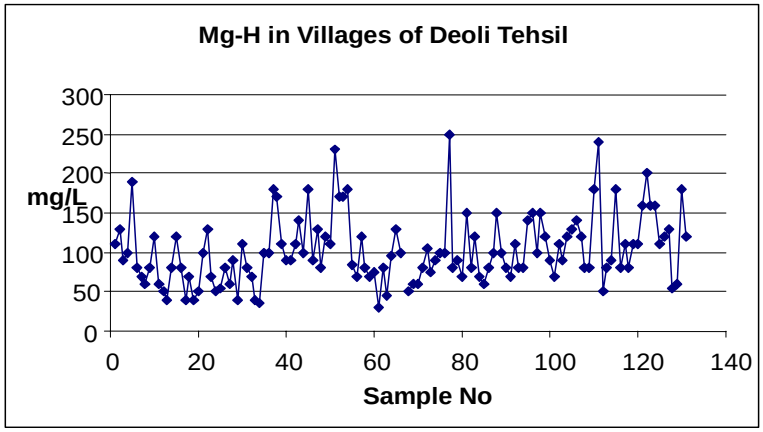

Fig. 2:

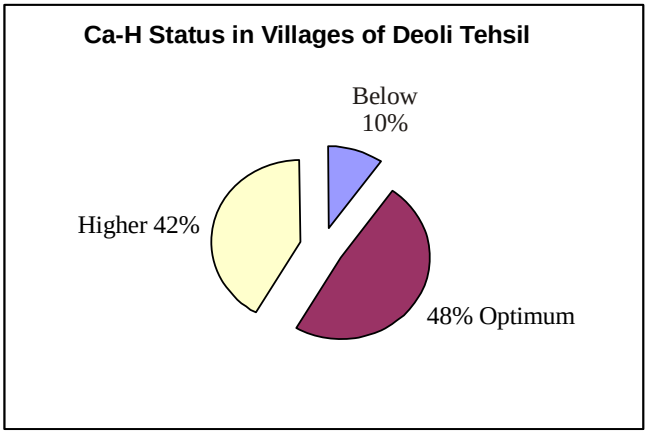

Fig. 3:

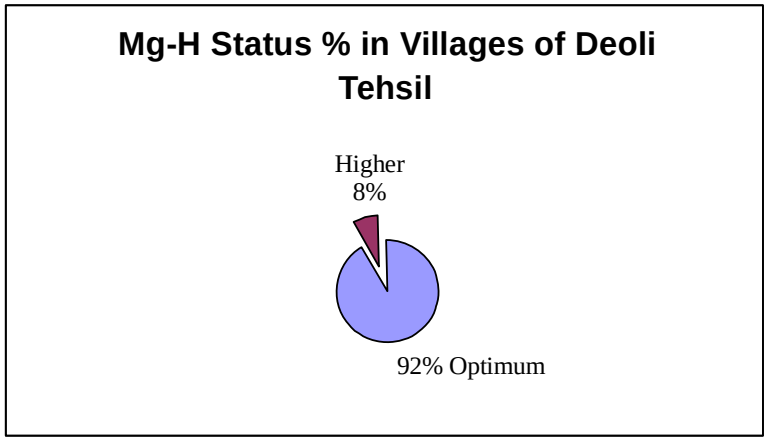

Fig. 4:

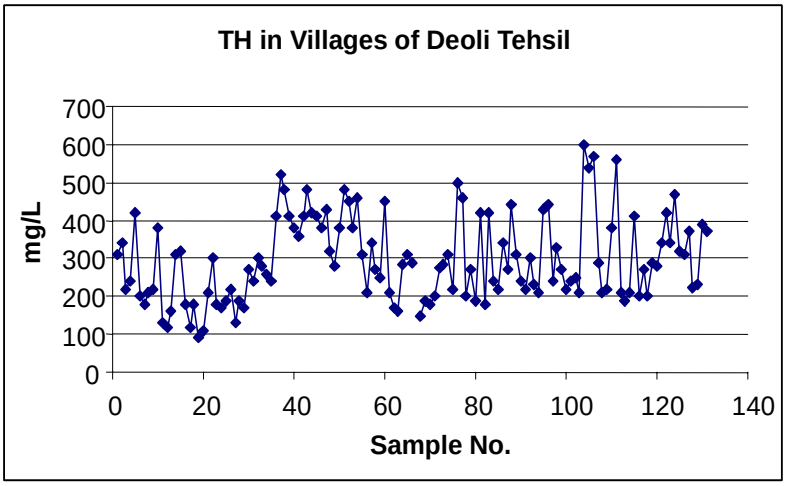

Fig. 5:

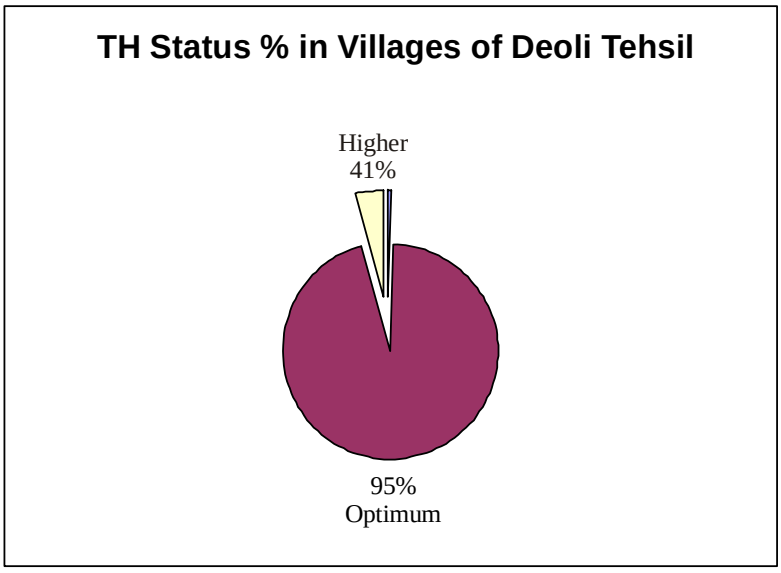

Fig. 6:

CONCLUSION

The presence or absence of the hardness in drinking water is not known to pose a health risk to users. Hardness is normally considered an aesthetic water quality factor. The presence of some dissolved mineral material in drinking water is typically what gives the water its characteristic and pleasant taste[10]. The study shows that Ca-H of ground water are higher than 42% permissible limit. This study reveals that ground water of the sources, which is used for drinking and house hold purposes is not potable with respect to hardness. There for suitable cost-effective indigenous treatment technologies should be search out and adopted to soften the hard water in the study area. High concentration of hardness is causes of hard disease, kidney disease and concer. Public awareness and health education are most important measure to be widely adopted. This can be done by using audio-visual aids, seminars, conferences, symposium and training N. G. O. s. must be encouraged in such programmed for public welfare.

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