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A Study on The Estimation of Hardness In Ground Water Samples Byedta Tritrimetric Method

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Abstract: *Water with high concentration of minerals is hard water. Water is essential for life. But water with very high degrees of hardness is harmful to health. 120 samples of ground water samples were collected from one town and two different villages. Hardness of water can be determined by EDTA tritrimetric method. Out of all the samples tested 39 (32.5%) samples were moderately hard, 76 (63.33%) samples were hard water and 5 (4.16%) samples were very hard water. Extreeme degrees of hardness is dangerous to health. The present study did not revealed any soft water. There is a false notion that hard water is harmful to health, its not hard water, its very hard water (>180ppm). The minerals that are supplemented to body through water will be beneficial to health in several ways. So public should be educated about degrees of hardness and its effects.*

Keywords: *EDTA tritrimetric method, Groundwater, Hardness*

I. Introduction

Hardness, a physico chemical property of water, is generally ameasure of calcium and magnesium ions in water. Zinc, iron,strontium, aluminum, and manganese can also contribute towater hardness; however, they are generally present in very lowconcentrations (NRC, 1974). These ions enter a water supplyby leaching from minerals of rocks and soil. Common calciumcontainingminerals are limestone (calcium carbonate) andchalk (calcium sulphate). A common magnesium mineral isdolomite, which also contains calcium (Gumashta *et al*., 2012).Initially, water hardness was understood to be a measure of thecapacity of water to precipitate soap, which is in practice the sum of concentrations of all polyvalent cations present in water(Ca, Mg, Sr, Ba, Fe, Al, Mn, etc.) later it has been generally accepted that hardness is defined as the sum of the Ca and Mgconcentrations, determined by the EDTA titrimetric method,and expressed in mmol/l (ISO, 1984) or as CaCO3 equivalentin mg/l (Standard Methods, 1998), less frequently as the CaOequivalent (Kozisek, 2003). The type of anion found in thesesalts distinguishes between the two types of hardness -carbonate and non-carbonate hardness. Carbonate hardness issometimes called temporary hardness because it can beremoved by boiling water. Non-carbonate hardness cannot bebroken down by boiling the water, so it is also known aspermanent hardness. In general, it is necessary to distinguish between the two types of hardness because the removal methoddiffers for the two. Total hardness includes both temporary andpermanent hardness caused by the calcium and magnesium, onthe basis of which water is categorized as soft or hard and very hard (Sengupta, 2013). From the technical point of view,multiple different scales of water hardness were suggested (e.g.very soft – soft – medium hard – hard – very hard). Expectedly,both extreme degrees (i.e. very soft and very hard) areconsidered as undesirable concordantly from the technical andhealth points of view, but the optimum Ca and Mg water levelsare not easy to determine since the health requirements may notcoincide with the technical ones (Kozisek, 2003).Health significance of water hardness was directly evidenced inthe late 1950's. The relationship between water hardness andthe incidence of vascular diseases was first described by aJapanese chemist Kobayashi (Kobayashi, 1957) who showed,based on epidemiological analysis, higher mortality rates fromcerebrovascular diseases (stroke) in the areas of Japanese riverswith more acid (i.e. softer) water compared to those with more

alkaline (i.e. harder) water used for drinking purposes.The World Health Organization says that "there does not appear to be any convincing evidence that water hardnesscauses adverse health effects in humans" (WHO, 2003). In fact, the United States National Research Council has found that hard water can actually serve as a dietary supplement for calcium and magnesium (NRC, 1974). Hard drinking water is generally not harmful to one's health,[1] but can pose serious problems in industrial settings, where water hardness is monitored to avoid costly breakdowns in boilers, cooling towers, and other equipment that handles water. In domestic settings, hard water is often indicated by a lack of suds formation when soap is agitated in water, and by the formation of lime scale in kettles and water heaters. Wherever water hardness is a concern, water softening is commonly used to reduce hard water's adverse effects. The livestock owners in the Mega animal health camp area, conducted by College of Veterinary Science, Proddatur, expressed doubt about the effects of hard water on animal health and production and degrees of hardness. Keeping in view of all these things the present study was carried out to estimate the amount of hardness in the ground water of those areas.

II. Materials And Methods

One Hundred and twenty samples (120) of ground water were collected from one town and two different villages while attending Mega Animal Health Camp organized by College of Veterinary Science, Proddatur, YSR Kadapa district, Andhrapradesh, India. All the water samples were collected aseptically in to sterilized screw capped glass bottles and brought to the laboratory. Hardness of all the water samples was tested by using EDTA-tritrimetric method by taking 50ml of water sample into a conical flask along with 100ml of ammonia buffer solution and 100-200-mg of Erichrome black- T indicator followed by tiatration with EDTA solution present in a burette. End point is noted down by changing of the water solution color from wine red to blue and expressed as CaCO3 equivalent in mg/l (Standard Methods, 1998). Amount of Hardness in water is calculated by using the formula. Hardness as mg/l CaCO3= ml of EDTA solution usedx1000/ Volume of water samples taken *United States Geological Survey had classified the water into hard and soft water, as per the table below*

Classification	hardness in mg/L	hardness in mmol/L	hardnessindGH/°dH	hardness in gpg	hardness in ppm
Soft	0-60	0-0.60	0-3.37	0-3.50	Less than 60
Moderately hard	61-120	0.61-1.20	3.38-6.74	3.56-7.01	60-120
Hard	121-180	1.21-1.80	6.75–10.11	7.06-10.51	120-180
Very Hard	≥181	≥1.81	≥ 10.12	≥10.57	≥180

Table showing the results for hardness of different ground water samples

S.No.	Place of sample collection	No.of samples	Classification based on degree of hardness in mg/L	
			No. of samples showing different degree ofhardness	Percentage of samples showing different degree of hardness
1	Proddatur town	40	S-0	S-0
			MH-17	MH-42.5
			H-21	H-52.5
			VH-02	VH-5
2	Sannapalli village	40	S-02	S-0
			MH-12	MH-30
			H-27	H-67.5
			VH-01	VH-2.5
3	Chinnakuravaluru village	40	S-0	S-0
			MH-10	MH-25
			H-28	H-70
			VH-02	VH-5

III. Results And Discussion

The present study had revealed that out of three places, the twovillages had shown high level of hardness compared to the town. In Proddatur town, out of 40 water samples collected, almost all the samples were moderately hard (42.5%) and hard water samples (52.5%). Only few samples were very hard water (5%) (Table). The results of Villages were different from the results of town. Forty each number of samples were collected from two villages. In Sannapalli village, more number of samples had shown hardness between 150-300mg/l of CaCO3 (67.5%) i.e

hardwater. Some of the samples had shown moderate hardness (30%) and very few of them have shown extreme hardness (2.5%)(Table). Similar type of results were found in the study of samples of Chinnakuravaluru village also. The results were hard water-70%, moderately hard water - 25% and very hard water - 5%. Finally no soft water sample was found in all the 120 samples (Table). Altogether out of 120 samples, most of the samples are hardwater (63.33%). There are only 5samples (4.16%) which arefound to be very hard water. According to Kozisek, (2003) both the extreme degrees of hardness are dangerous to human health i.e very hard and very soft water. The present study did not revealed presence of any soft water, but it had reported very hard water in about 4.16% of the samples which is negligible. Water intake of cattle and milk production were unaffected by water containing up to 290 ppm of hardness (NRC, 1974). So the water in the above three places may not decrease the water intake and milk production of cattle in the above said areas. Hard drinking water is generally not harmful to one's health, (WHO, 2003) but can pose serious problems in industrial settings. Most of the people especially housewives dislike hard

water because it does not lather well or does not taste good, but they may not be knowing that it may prolong their lives, and more especially their husbands (Time, Medicine, 2011). Calcium, one of the components of hard water, can be protective because it makes water less corrosive and less likely to leach toxic trace minerals, such as cadmium and lead, out of metal pipes (Seelig, 1989). According to the U.S. National Academy of Sciences by 1977 there had been more than 50 studies, in nine countries, that had indicated an inverse relationship between water hardness and mortality from cardiovascular disease (Harold and Foster,

1994). Most of the scientists have indicated a negative statistical association of various types of cancer morbidity/mortality with the hardness of water and calcium (Yang, 1998). Some studies correlate domestic hard water usage with increased eczema in children (McNally, 1998, Miyake *et al*., 2004 and Arnedo-Pena, 2007).

IV. Conclusion

The present study had revealed extreme degrees of hardness in only 4.16% of the samples which may not be harmful to the people. Although most of the people dislikes to use hard water, magnesium and calcium are having some protective effect on cardiovascular mortality, the evidence being debated and does not prove causality and also the drinking water is the source of calcium and magnesium intake which are essential for the body. Most of the people are in false opinion that hard water is harmful to health, it's not hard water, it's very hard water (extreme degrees of hardness). So it would be better if we bring awareness among the public.

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