

An Analysis of Hard Water's Impact on Human Health

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ABSTRACT

Water is a clear, colourless, odourless, and tasteless chemical substance that is used as a universal solvent. Water is necessary for life because it keeps us hydrated. As per the Bureau of Indian Standard, water with a total dissolved value. If a solid content of more than 500 parts per million is present, the water may be hard or moderately hard, and long-term continuous use of it may have negative health effects. It is necessary to constantly monitor the quality of water from various sources of supply using quantitative frameworks of the physicochemical and biological components of drinking water. This essay seeks to investigate.

KEYWORDS

Water, reuse, recycling, hard water and human health

INTRODUCTION

Through the sharing of electrons, two hydrogen atoms and one oxygen atom form a covalent connection in a water molecule. Living creatures employ water as a great solvent since many biological Reactions only occur in solutions that contain water. Water's polarity and capacity to generate hydrogen bonds allow it to dissolve a wide range of compounds.

Rain water and treated water is soft water which contains low concentration of calcium and magnesium ions and produces lather easily with soap. Hardness is the physico-chemical property of water which prevents lather formation with soap due to presence of high mineral contents. Hard water is formed when water percolates through deposits of calcium and magnesium minerals such as sea water, river water and tap water. Hardness of water is classified into two types, carbonate and non-carbonate hardness. Carbonate hardness also called temporary hardness is due to the presence of bicarbonate and carbonate salts of calcium and magnesium. It can be removed by boiling water. Non-carbonate hardness also known as permanent hardness is due to the presence of calcium chloride, magnesium chlorides and magnesium sulphate. Scientific studies reported that the minerals present in hard water react with soaps to form a scum like substance that can clog pores and the result may be dry skin, eczema, dandruff, damaged hair. Kobayashi, a Japanese chemist, was first to describe the relation between water hardness and the incidence of vascular disease.

Sources of Hard Water- We know that what are the sources of drinking water in India such as wells, hand pumps, bore wells and tube wells and surface water sources like rivers and lakes. Hard water is caused by the presence of high amount of dissolved minerals and impurities picked up by it when it travels through the ground. When water moves continuously through soil and rocks on our earth, it gets contaminated by the absorption of high mineral contents and becomes hard water. Calcium and magnesium salts, dissolved other metal salts, bicarbonates, silicates and sulphates are governing causes of hardness of water. Hard water is defined as water that contains soluble salts of calcium and magnesium as Bicarbonates, Chlorides and Sulphates. Types of water hardness Water hardness is of two types: temporary hardness and permanent hardness. Temporary stiffness is caused by the soluble calcium and magnesium salts present in the water as bicarbonates. is type of hardness, also called carbonate hardness can be removed by boiling the water. Boiling the water assists the reaction liberating carbon dioxide which drives off and the carbonate ion reacts with Ca^{2+} or Mg^{2+} ions to form insoluble calcium and magnesium carbonates which filter out and available water is become soft.



Persistent hardening is due to the presence of soluble chlorides and calcium, magnesium and sulphates in the water and these can't be removed by boiling water. There are several ways to remove permanent stiffness in water, such as Calgon method, ion exchange method, soda bath method etc.

Health effects of hard water- The hardness of the water can cause salts to build in the boilers and hot water pipes, reducing their efficiency. Since hard water is difficult to produce, it is not recommended for washing.

make a soapy lather. According to the World Health Organization, there are no documented harmful effects of hard water on health. There are no significant health consequences linked to consuming hard water. However, because it includes calcium and magnesium, which build teeth and bones, solid water serves as a nutritional supplement. Because dissolved minerals are highly concentrated in hard water, millions of people believe that these dissolved minerals have favourable impacts on its consumers' health. Hard water's calcium and magnesium content has been linked in numerous studies to possible heart disease prevention.

Consumption of hard water can give to dry skin and hair. Studies have been conducted on health effects of hard water. It has been reported that drinking hard water might link to the formation of conditions of certain diseases. Hard water can change the pH balance of the skin leaving our skin less healthy than before. Hence people with skin disease may find their disease condition increasing when they wash with hard water the pH ranges from 0 to 14 indicates how acidic or alkaline the substance is. Acidic water has pH less than 7 and alkaline water has pH greater than 7 and neutral pure water has 7 pH value. The pH balance of skin can be changed due to use of

hard water, which decrease the protective strength of skin against bacteria and infections the skin problems are caused by the presence of excessive minerals in the water. About 80 percent of disease in developing countries is caused by consuming contaminated water, yet many of the households across the country do not treat their drinking water. the Bureau of Indian Standard (BIS) has developed a guide for safe drinking water. The World Health Organization confirms the harmful effects of the constant use of hard water on the cardiovascular system. the human body gets calcium and magnesium from organic compounds of food but hard water contains inorganic compounds of these elements, and hence they are absorbed unacceptable. As a result, accumulation of excess salts in the joints may happen and thus problems of the musculoskeletal system.[10] Dangerous bacterial growth in drinking water carrying pipes due to hard water scale deposits is very harmful for human health because the scale deposits have an uneven, rough surface which are a perfect hiding place for bacteria to nest in. Excess calcium present in hard water may cause kidneys work harder to filter, stomach upset, nausea and constipation. Hypercalcemia may interfere functions of brain and heart.

CONCLUSION

Water pollution is an important environmental issue that can be due to many contaminants. Consumption of the polluted water may affect the human health. Although compounds of calcium and magnesium present in hard water are very important elements for the functioning of all living organisms, their excess and inorganic origin have harmful effect on living commodity. Various initiatives have been undertaken by government and non-government bodies to solve water crisis around the country.

REFERENCES

1. P. Ramya et al, A Study On the Estimation Of Hardness In Ground Water Samples By Edta Tritrimetric Method. International Journal of Recent Scientific Research Vol. 6, Issue, 6, pp.4505-4507, June, 2015
2. Sana Akram, Hardness in drinking water, its sources, its effects on humans and its Household Treatment, June 2018, <https://www.researchgate.net/publication/325781174>, Last seen 15th Jan and-soft-water#hard-waterrisks (log on 05th Jan 2022)
3. Pallav Sengupta, Potential Health Impacts of Hard Water, Int J Prev Med. 2013
4. Aug; 4(8): 866–875. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3775162/4.Ibid.5>
5. James Roland: Hard Water vs. Softs Water: Which One Is Healthier?: Posted on the website July 30, 2019, <https://www.healthline.com/health/hardwater>
6. Safe Drinking Water Guidelines in India: Posted 13th Dec. 2019, <https://www.kent.co.in/blog/safe-drinking-water-guidelines-in-india/> Last seen 05th Jan 2022.

7. R. P. Dahiya : Researchgate : Posted August 2006, https://www.researchgate.net/figure/Drinking-water-quality-standards-as-recommended-by-BISand-WHO_tbl4_6888743, Last seen 06th Jan 2022.

Apéndice

Grains/Gallon	Mg/l and ppm	Classification
Below 01	Below 17.1	It is Soft
From 1.0 to 3.5	From 17.1 to 60	It is Slightly hard
From 3.5 to 7.0	From 60 to 120	It is Moderately hard
From 7.0 to 10.5	From 120 - 180	It is Hard
From 10.5 and over	From 180 and over	It is Like a stone
Note: one grain per gallon = 17.1 part per million (ppm)		

Figure 1

Water hardness scale

<https://www.edrocorp.com/141104news.html>

Parameters	Acceptable limit	Permissible limit in the absence of alternative source
pH Value	6.5-8.5	No relaxation
Turbidity (NTU unit)	1	5
Total Dissolved solid (mg/l)	500	2000
Total hardness as CaCO ₃ mg/l (Max)	200	600
Total Iron as Fe mg/l (Max)	0.3	No relaxation
E coli presence / absence	Shall not be detectable in any 100 ml sample	Shall not be detectable in any 100 ml sample
Taste	Agreeable	Agreeable
Odour	Agreeable	Agreeable

Figure 2

BIS 1500-2012 the acceptable limit of bacteria and other contamination in drinking water