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The Comparative Analysis of the Hardness of Water of Surface Drinking Water Sources And Underground Drinking Water Sources In Pokhara

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Abstract – The chemical analysis of the underground boring water of almost of all sources and the surface river water sources used for drinking water in PokharaSub-metropolitan City, were carried out.The character selected for the finding was the hardness of water of the different sources which is the one of the major drinking water parameter. The samples for the chemical test Mardykhola(river), Ghatekhola(river) and the river source of Fulwari reservoir were selected as surface drinking water sources and P.N. campus, Tangbe boring, Eye hospital boring, Manipal boring and Tribeni boring as underground drinking water sources were taken for analysis. The chemical test was done by the EDTA titration method. The comparative hardness was displayed by the different Pi-charts. The river drinking water source of Pokhara is foud in between 94-116mg/l. The boring drinking water source of Pokhara is foud in between 80-190 mg/l. The well drinking water source of Pokhara is foud in between 20-60 mg/l.

Keywords: Instrumentation, Microbes, Permissible, Photosynthesis, Titration.

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1. INTRODUCTION

Water is an essential substance for all living beings. A molecule of water is made up of two atoms of Hydrogen and one atom of oxygen. It plays vital role in mainly in the photosynthesis process in green plants and the digestive system of all living beings. As our body contains about 70% water and 90% of vertebrates blood contains water we should drink water continuously to maintain the regulation, prevention and circulation of blood in the body[3,5].

As we know that 2/3rd part of the earth contains water but still there is limited drinking water everywhere because less number of sources of water can supply standard drinking water which have less chemical & microbe parameters within the permissive levels recommended by W.H.O.fordrinking[2,6].Despite of excessive availability of water, chemical impurities (like high percentage of iron, calcium & magnesium ions,ammonia, nitrate, nitrite,phosphate,manganese and mercury etc. or Microbes likeE.coli, Giardia and Entamoeba etc.) are present so the water in the all sources cannot be drinkable. Somewhere people are not so conscious about it and they are drinking the impure water from the sources[11].Our country is the second richest country in the world in water,but the maximum number of water sources cannot be used as drinking water sources because their chemical and microbes parameters are beyond the limitation of quality of drinking water[1,4]. Many of the water sources contain such the impurities that they cannot be easily and economically purified for drinking purposes. The quantity of water volume from the drinking sources decreases in the winter- season in all areas of Terai, hill and mountain in our country. Comparing to last three decades due to the great variation in global climate,some of the sources of underground water become dry which create serious problem of drinking water for general public[14].

Whether different sources are used as drinking water sources inPokhara sub-metropolitan city(PSMC) but overall they can categorized as of main two types (i) surface drinking water sources in which people areusing drinking water from the rivers,khola,rivulets, and spring water. (ii) Under-ground water source in which people are using drinking water from Borings and Wells. Most of the wells are found at the remote area of PSMC while boring water and surface drinking water through water supply corporation office, the drinking water is supplied in the central part of the city.When water is not sufficient in dry season then most of the people in PSMC use insufficient water from Boring water i.e. Private drinking water supply.Generally, people of remote areas fulfill their needs of drinking water through sources like wells. Many of the wells are very old and

not well maintained. Quantity of water from wells can't meet the need of the growing population due to fluctuation of water quantity. Some wells are far from the PSMC,they use to clean their clothes and take bath and they bring water from there for drinking purpose. Many of the people take their heavy vehicles to the rivers to clean properly which severely contaminates the water in the rivers[4]. In Pokhara, according to the survey of 2012-2013, water demand and supply situation tells that total production during the period as given in the data is in wet season 33.9 ML/d while in dry season is 30.8 ML/d but requirement of total supply of water should be 38 ML/d, but the demand increases in 2014 up to 41 ML/d.Due to lack of perfect and efficient supply system output of total production is not according to the total production capacity. The drinking water is brought from rivers like Mardykhola (river) and Bhotekhola (river). But, as water can not fulfilled according to demand of rapid population growth, many private borings (underground water) supply their water to meet the needs. As there is fluctuation in the parameters of drinking water sources due to heavy rain and complicated geographical situation, drinking water test is necessary. As the total hardness shows the presence of ions present in drinking water it needs to be measured by very reliable method of titration[13]. The parameter should be within the permissive level laid down by WHO[12] and NDWQS (Nepal drinking water quality standard) are 300 mg/l and 100-500 mg/l respectively while according to Indian standard drinking water parameter (1991) the desirable level is 300 mg /l. If the parameter exceeds the limitation the water should be treated properly for use[8].

Proper cares must have taken for sampling the water from different drinking water sources because a little impurity affects the test which influences the result. Hence the container was neat and cleanphysically, chemically and microbiologically[10].

In the same way, the test of microbes [9] and other chemical test of inorganic ions as Iron, Arsenic, Lead, mercury, Calcium and Magnesium can be carried out[7].

2. EXPERIMENTAL METHODS

Mardykhola, Ghatekhola and river source of Fulwari reservoir were selected surface drinking water source and P.N. campus, Tangbe boring, Eye hospital boring, Manipal boring and Tribeni boring as underground drinking water sources were selected for total hardness test. They were taken to KUKL central lab. The total hardnesswas measured by E.D.T.A. titration test method.. The readingwas compared with the permissive level of WHO and NDWQS.

Total hardness – EDTA titration method.

Procedure: With prepared chemicals , to certain volume of sample prepared 0.2gm of solo chrome black T indicator is mixed and 2ml ammonia buffer (prepared). Then titration is done with standard E.D.T.A. (prep) solution until last redish tinge disappears.

Total hardness = $T \times F/V \times 1000$ mg/1 $CaCO_3$ where F is molarity factor of EDTA and V is volume of sample and T is volume of titrant [EDTA]

3. RESULTS AND DISCUSSION

Table: 1 Data obtained fortotal hardness testof river drinking water sources and boring drinking water sources from central lab. of KUKL, Kirtipur, Kathmandu.

S.N.	Name of the samples	total hardness test (mg/l)
1	Mardikhoa river water	94
2	Bhotekhola river water	48
3	FulwariResevoir river water	116
4	P.N. Campus Boring water	80
5	Tangbe Boring water	150
6	Eye Hospital Boring water	190
7	Manipal Boring water	114
8	Tribeni Boring water	180
9	Dharapani well water	20
10	Simpani well water	60

Sources: Laboratory Report, water quality section KUKL &self-designed pi-chart.

The above data of Pi-charts show that the hardness ranges from 20mg/l to 190mg/l in all the river, boring and well drinking water sources. All pi-charts are made on the basis of lab. Report of KUKL, water quality section.

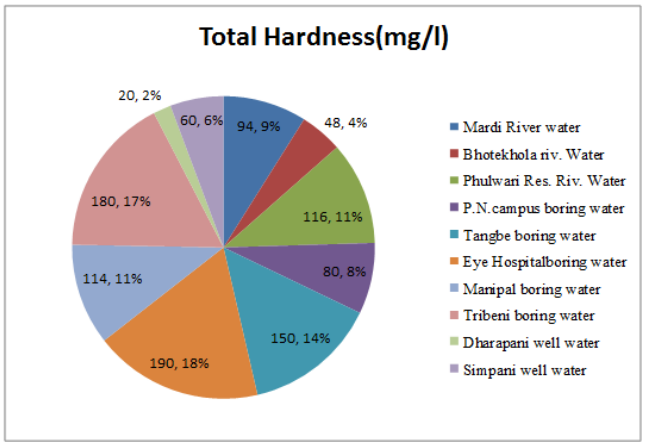

Fig.1 Total hardness of the drinking water of the different drinking water sources

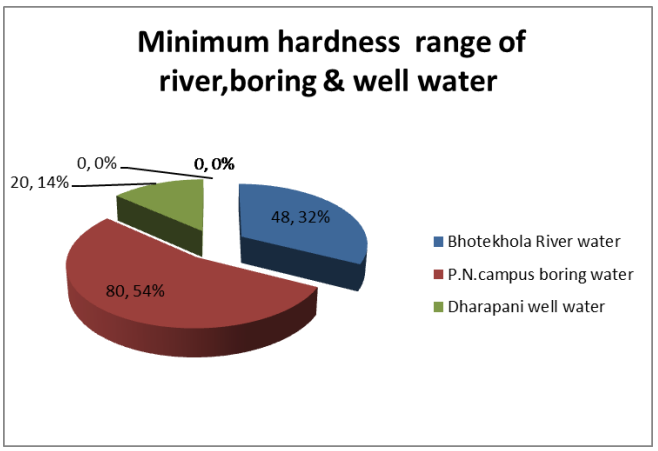

Fig.2 Sources: Laboratory Report, water quality section KUKL & self-designed pi-chart.

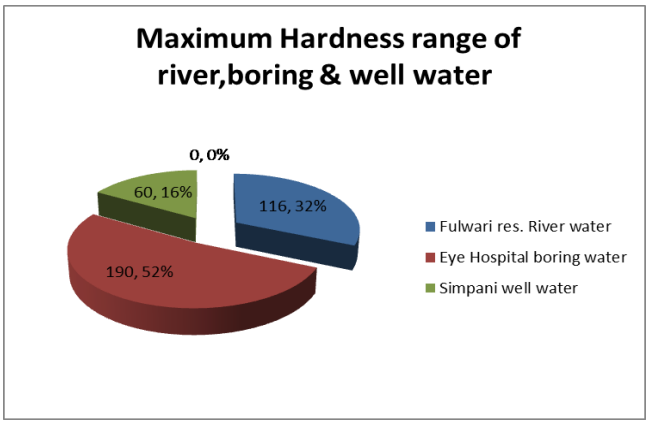

Fig.3 Sources: Laboratory Report, water quality section KUKL & self-designed pi-chart.

TOTAL HARDNESS

Viewing the maximum minimum ranges of hardness of water the well water is the softest among them. The boring water is harder than well water while river water range is in between them.

It is present in between 80-190 mg/l but permissive level is 500 mg/l, therefore the samples water is fit for drinking purpose. Hardness is caused by dissolved calcium and magnesium, and is expressed as the equivalent quantity of calcium carbonate. On heating, hard water has a tendency to form scale deposits and can form excessive scum with regular soaps. However, certain detergents are largely unaffected by hardness. Conversely, soft water may result in accelerated corrosion of water pipes. Hardness levels between 80 and 100 mg/L as calcium carbonate (CaCO3) are considered to provide an acceptable balance between corrosion and incrustation. Water supplies with hardness greater than 200 mg/L are considered poor but tolerable. Hardness in excess of 500 mg/L in drinking water is unacceptable for most domestic purposes.

Ontario Regulation 169/03, Ontario Drinking-Water Quality Standards, made under the Safe Drinking Water Act, 2002, prescribes drinking-water quality, the operational guideline for hardness in drinking water is set at between 80 and 100 mg/L as calcium carbonate. Because more % of Ca and Mg ions in drinking water will create gastritis problem for persons having poor digestion.

The above data of Pi-charts show that the minimum total hardness ranges from 20 to 80 mg/l and the maximum total hardness ranges from 60 to 190 mg/l in all the river, boring and well drinking water sources. All pi-charts are made on the basis of lab. Report of KUKL, water quality section.

CONCLUSIONS

I) The underground boring water of all sources are chemically viewing the total hardness fit for drinking purpose as the chemical parameter is within the permissive levels laid down by WHO and NDWQS.

II) The surface river water sources used for drinking water in PSMC is fit for drinking purpose viewing the chemical parameter total hardness is within the limitation for drinking purpose.

III) Over all data shows that average total hardness of the river water sources contain less average total hardness than the boring

water sources hence river water is softer than boring water viewing this parameter.

IV) As in the Pi-chart the minimum range of the total hardness among all given sources was found 20 mg/l while the maximum range was found as 190 mg/l.

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