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Quantitative Chemical Analysis of Water of Different Areas of Bangalore

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Abstract: Water samples were collected in a proper manner from three different sources from densely populated areas of Bangalore namely Kaveri water(sample no. 1) Bore well water(sample no. 2) and Government supplied water(sample no. 3) and were chemically analyzedfor 14 important parametersby following standard methods. Chemicals, glassware and instruments used were of standards companies. On comparing with standard permissible limits,. Experimental results obtained are alarming. Deviation from permissible limits may be arranged in the following trend
Sample no. 1< Sample no, 3 < Sample no. 2
Keywords: Titration,Salts, Conductivity,P^H, Flame photometer, Burette,Distillation

1. Introduction

Human body contains(70 kg) 0.75 kg sodium ,0.25 kg potassium ,0.42 kg magnesium ,1.17 kg calcium and the rest other elements **. Water is universal solvent and it dissolves many inorganic and organic matters with it depending on availability of that matter .Organic and inorganic matter has effect on our body. Hence to know the quantity of matters present in our drinking water,analysis is indispensable.**

Human water and salt balance

Calcium And Magnesium Calcium an Magnesium perform vital function in biological system, Green plants conduct the process of photo synthesis in the presence of sun light and the magnesium containing pigment chlorophyll., Large amount of calcium are present in bone tissue. Calcium is involved in enzyme system also. It plays a role in regulating muscle contraction , transmitting nervous pulses and act as agent of blood coagulation ,Calcium enters the body with food and water in the form of neutral phosphate which is converted into readily soluble acid phosphate. The acid phosphate are absorbed in the blood plasma, The concentration of calcium human being is in between 0.0022-0.0028 mole / dm^3. Along with potassium and Magnesium , the calcium ions effect the rate of muscular contraction including that of cardiac muscle , and the action of cardiac glucoside . An overdose ofglycoside leads to cardiac arrest ..Na^+ ,K^+ ,Mg^{++} ,and Ca^{++} ions perform a variety of function in animal and plant organisms.

Although the system for maintaining optimal salt and water balance in the body is a complex one, one of the primary ways in which the human body keeps track of loss of body water is that osmoreceptors in the hypothalamus sense a balance of sodium and water concentration in extracellular fluids. Relative loss of body water will cause sodium concentration to rise higher than normal, a condition known as hypernatremia. This ordinarily results in thirst. Conversely, an excess of body water caused by drinking will result in too little sodium in the blood (hyponatremia), a condition which is again sensed by the hypothalamus, causing a decrease in vasopressin hormone secretion from the anterior pituitary, and a consequent loss of water in the urine, which acts to restore blood sodium concentrations to normal.

Severely dehydrated persons, such as people rescued from ocean or desert survival situations, usually have very high blood sodium concentrations. These must be very carefully and slowly returned to normal, since too-rapid correction of hypernatremia may result in brain damage from cellular swelling, as water moves suddenly into cells with high osmolar content.

In humans, a high-salt intake was demonstrated to attenuate nitric oxide production. Nitric oxide (NO) contributes to vessel homeostasis by inhibiting vascular smooth muscle contraction and growth, platelet aggregation, and leukocyte adhesion to the endothelium [19]

Sodium and potassium distribution in species

Plants

In C4 plants, sodium is a micronutrient that aids in metabolism, specifically in regeneration of phosphoenolpyruvate (involved in the biosynthesis of various aromatic compounds, and in carbon fixation) and synthesis of chlorophyll.In others, it substitutes for potassium in several roles, such as maintaining turgor pressure and aiding in the opening and closing of stomata. Excess sodium in the soil limits the uptake of water due to decreased water potential, which may result in wilting; similar concentrations in the cytoplasm can lead to enzyme inhibition, which in turn causes necrosis and chlorosis. To avoid these problems, plants developed mechanisms that limit sodium uptake by roots, store them in cell vacuoles, and control them over long distances;excess sodium may also be stored in old plant tissue, limiting the damage to new growth.

Animals

Since only some plants need sodium and those in small quantities, a completely plant-based diet will generally be very low in sodium. This requires some herbivores to obtain their sodium from salt licks and other mineral sources. The animal need for sodium is probably the reason for the highly conserved ability to taste the sodium ion as "salty Receptors for the pure salty taste respond best to sodium, otherwise only to a few other small monovalent cations (Li^+, NH_4^+, and somewhat to K^+). Calcium ion (Ca^{2+}) also tastes salty and sometimes bitter to some people but, like potassium, can trigger other tastes.

Sodium ions play a diverse and important role in many physiological processes, acting to regulate blood volume, blood pressure, osmotic equilibrium and P^H

Humans

The minimum physiological requirement for sodium is between 115 and 500 milligrams per day depending on sweating due to physical activity, and whether the person is adapted to the climate] Sodium chloride is the principal source of sodium in the diet, and is used as seasoning and preservative, such as for pickling and jerky; most of it comes from processed foods. The Adequate Intake for sodium is 1.2 to 1.5 grams per day, but on average people in the United States consume 3.4 grams per day, the minimum amount that promotes hypertension. (Note that salt contains about 39.3% sodium by mass—the rest being chlorine and other trace chemicals; thus the UL of 2.3g sodium would be about 5.9g of salt—about 1 teaspoon)

Function of sodium ions whenever there is an increase in sodium concentration in the blood, the kidney releases most of it in order that there will be enough water for use of the body. But when there is a decrease in its concentration, there is more release of water to store more sodium which the body needs dearly. This process is known as osmo-regulation.Sodium is the primary cation (positive ion) in extracellular fluids in animals and humans. These fluids, such as blood plasma and extracellular fluids in other tissues bathe cells and carry out transport functions for nutrients and wastes. Sodium is also the principal cation in seawater, although the concentration there is about 3.8 times what it is normally in extracellular body fluids.Urinary sodiumBecause the hypothalamus/osmoreceptor system ordinarily works well to cause drinking or urination to restore the body's sodium concentrations to normal, this system can be used in medical treatment to regulate the body's total fluid content, by first controlling the body's sodium content. Thus, when a powerful diuretic drug is given which causes the kidneys to excrete sodium, the effect is accompanied by an excretion of body water (water loss accompanies sodium loss). This happens because the kidney is unable to efficiently retain water while excreting large amounts of sodium. In addition, after sodium excretion, the osmoreceptor system may sense lowered sodium concentration in the blood and then direct compensatory urinary water loss in order to correct *the hyponatremic (low blood sodium)*

Conductivity: Salinity and conductivity measure the water’s ability to conduct electricity, which provides a measure of what is dissolved in water. In the SWMP data, a higher conductivity value indicates that there are more chemicals dissolved in the water Conductivity measures the water’s ability to conduct electricity. It is the opposite of resistance. Pure, distilled water is a poor conductor of electricity. When salts and other inorganic chemicals dissolve in water, they break into tiny, electrically charged particles called ions. Ions increase the water’s ability to conduct electricity. Common ions in water that conduct electrical current include sodium, chloride, calcium, and magnesium. Because dissolved salts and other inorganic chemicals conduct electrical current, conductivity increases as salinity increases. Organic compounds, such as sugars, oils, and alcohols, do not form ions that conduct electricity.

Importance of conductivity

Aquatic animals and plants are adapted for a certain range of salinity. Outside of this range, they will be negatively affected and may die. Some animals can handle high salinity, but not low salinity, while others can handle low salinity, but not high salinity.

In addition to its direct effects on aquatic life, salinity also has many other important effects o

Alkalinity can be defined as the ability of a water to neutralize acid or to absorb hydrogen ions. It is the sum of all acid neutralizing bases in the water. ... The bacteria and other biological entities which play an active role in wastewater treatment are most effective at a neutral to slightly alkaline pH of 7 to 8.

Total dissolved solids (TDS) is a measure of the combined content of all inorganic and organic substances contained in a liquid in molecular, ionized or micro-granular (colloidal sol) suspended form. Generally the operational definition is that the solids must be small enough to survive filtration through a filter with two-micrometer (nominal size, or smaller) pores. Total dissolved solids are normally discussed only for freshwater systems, as salinity includes some of the ions constituting the definition of TDS. The principal application of TDS is in the study of water quality for streams, rivers and lakes, although TDS is not generally considered a primary pollutant (e.g. it is not deemed to be associated with health effects) it is used as an indication of aesthetic characteristics of drinking water and as an aggregate indicator of the presence of a broad array of chemical contaminants.

Total dissolved solids are differentiated from total suspended solids (TSS), in that the latter cannot pass through a sieve of two micrometers and yet are indefinitely suspended in solution. The term "settleable solids" refers to material of any size that will not remain suspended or dissolved in a holding tank not subject to motion, and excludes both TDS and TSS.[1] Settleable solids may include larger particulate matter or insoluble molecules.

Chemical Oxygen Demand

Chemical Oxygen Demand is an important water quality parameter because, similar to BOD, it provides an index to assess the effect discharged wastewater will have on the receiving environment. Higher COD levels mean a greater amount of oxidizable organic material in the sample, which will reduce dissolved oxygen (DO) levels. A reduction in DO can lead to anaerobic conditions, which is deleterious to higher aquatic life forms. The COD test is often used as an alternate to BOD due to shorter length of testing time.

Chloride

A chloride test measures the level of chloride in our blood or urine. Chloride is one of the most important electrolytes in the blood. It helps keep the amount of fluid inside and outside of our cells in balance. It also helps to maintain proper blood volume, blood pressure, and pH of our body fluids. Tests for sodium, potassium, and bicarbonate are usually done at the same time as a blood test for chloride.

Most of the chloride in our body comes from the salt (sodium chloride) we eat. Chloride is absorbed by our intestines when we digest food. Extra chloride leaves our body through our urine.

Sometimes a test for chloride can be done on a sample of all our urine collected over a 24-hour period (called a 24-hour urine sample) to find out how much chloride is leaving our body through our urine.

Chloride can also be measured in skin sweat to test for cystic fibrosis

SULPHATE

Sulphate contributes to numerous processes in mammalian physiology, particularly during development. Sulphotransferases mediate the sulphate conjugation (sulphonation) of numerous compounds, including steroids, glycosaminoglycans, proteins, neurotransmitters and xenobiotics, transforming their biological activities. Importantly, the ratio of sulphonated to unconjugated molecules plays a significant physiological role in many of the molecular events that regulate mammalian growth and development. In humans, the fetus is unable to generate its own sulphate and therefore relies on sulphate being supplied from maternal circulation via the placenta. To meet the gestational needs of the growing fetus, maternal blood sulphate concentrations double from mid-gestation. Maternal hyposulphataemia has been linked to fetal sulphate deficiency and late gestational fetal loss in mice. Disorders of sulphonation have also been linked to a number of developmental disorders in humans, including skeletal dysplasias and premature adrenarche. While recognized as an important nutrient in mammalian physiology, sulphate is largely unappreciated in clinical settings. In part, this may be due to technical challenges in measuring sulphate with standard pathology equipment and hence the limited findings of perturbed sulphate homoeostasis affecting human health. This review article is aimed at highlighting the importance of sulphate in mammalian development, with basic science research being translated through animal models and linkage to human disorders.

PH

The lower the pH, the more acidic, and the higher, the more alkaline. Neutral pH is 7.0, the pH of water, and your level is in a healthy range between 6.0 to 7.5. According to Merck Manuals Online Medical Library, blood that is slightly alkaline, or 7.35 to 7.45, is optimal for proper body functions

Due to above mentioned importance of nutrients present in water it became necessary to analyze the drinking water .We collected water samples from three different water sources of residential areas of Bangalorenamely 1 supplied Kaveri water(sample no. 1) ,2. Bore well water from chemical industrial area Peenya ,shivpura NTT Colony Bangalore (sample no. 2) 3. Government supplied water,Sai Baba temple near Acharya college Bangalore(sample no. 3) and analyzed these properly.

2. Methodology

In present water analysis all fourteen parameters were done by following standard methods.Total hardness,calcium,magnesium ,chloride, .total alkalinity,chemical oxygen demand were performed by following Titration method.P^H was measured by P^Hmete. .Sodium and Potassium were measured by use of Flame Photo meter and conductivity was measured by use of conductivitymeter.

3. Experimental

Chemicals Required Sodium hydroxide ,EDTA ,Murexide Indicator(Ammonium perpurate),Sulphuric acid ,Eriochrome black T ,Barium chloride,Silver nitrate ,Potassium chromate ,Potassium Dichromate ,Methyl Orange ,Phenolphthalein ,Hydrochloric acid etc.All chemicals were of Merck grade

Glassware Required Burette, Pipet,Measuring cylinder, Beaker etc.Aii glassware were used during experiments were of Borosil.

Instruments Required P^Hmeter,conductivity meter ,Flame photo meter ,Electronic Balance,Bunsen burner etc

All reagents were made in pure distilled water and instruments were calibrated before use .Chemicals werecalculated exactly and weighed accurately by use of electronic balance. Water samples collected from three areas were filtered by Whatman Filter paper no. 40 and were called as Sample No. 1,Sample No. 2 and Sample No. 3. Results obtained are tabulated in the following Table no. 1

Experimental Results

TABLE 1

SN.	NAME OF PARAMETERS	SAMPLE NO. 1	SAMPLE NO. 2	SAMPLE NO. 3	***PERMISSIBLE LIMIT(BIS)***
1	P^H	7.07	8.02	8.02	6.5-8.5
2	COLOR	COLOURLES	COLOURLESS	COLOURLESS	AGREEABLE
3	ODOUR	ODOURLESS	OOURLESS	OOURLESS	AGREEABLE
4	TOTAL HARDNESS OF WATER	548 .0 PPM $CaCO_3$	1008.0 PPM $CaCO_3$	434.0 PPM $CaCO_3$	<300 mg/L
5	CALCIUM	30.0 mg/L	160.0mg/L	140.0mg/L	<75 mg/L
6	MAGNASIUM	44.0mg/L	344.0mg/L	77mg/L	<30 mg/L
T	CHLORIDE	77.0mg/L	362.1mg/L	216.0mg/L	<250 mg/L
8	SULPHATE	740.582 PPM $CaCO_3$	411.434 PPM CaCO3	370.29PPM $CaCO_3$	< 200 mg/L
9	TOTAL ALKALINITY	308.0PPM CaCO3	946.0PPM $CaCO_3$	814.0PPM $CacO_3$	<200 mg/L
10	TOTAL DISSOLVED SOLID	600 mg/L	1600.0mg/L	600.0 mg/L	, 500 mg/L
11	CONDUCTIVITY AT 34^0C	0.106 $Ohm^{=1}Cm^{=1}$	1.696 $Ohm^{=1}Cm^{-1}$	1.06 $Ohm^{=1}$ $Cm^{=1}$	600 micro mho per cm
12	SODIUM	2.5 PPM	8.126 PPM	9.375 PPM	<20 mg/l
31	POTASIUM	1.48 PPM	8.157 PPM	10.374 PPM	No limit mentioned
14	CHEMICAL OXYGEN DEMAN	5.76 mg/L	12.67 mg/L	2.88 mg/L	< 250 mg/L

4. Results and Discussion

$P^H$of all three samples are well within the permissible limit .Color and odors of all samples are agreeable. Total hardness and Magnesium of all three samples are more than prescribed limit. Calcium in sample no. 1 is within the limit but in sample no. 2 and 3 it is more than limit. Excess of calcium and magnesium present in water may be due to presence of organic matters in it .In sample 1 chloride is within limit but in sample 2 and 3 it is more .This is due to presence of excess calcium and magnesium in sampleno. 2 and 3. Sulfate and total alkalinity is more in all three samples this may be due to increased P^H value and presence of bicarbonate in samples. Total dissolved solid (TDS) is also more in all three samples this is due to presence of more quantity of calcium, magnesium, iron and ,sulfate in water sample , Conductivity is more in all three samples. More conductivity means in samples salts are more. Sodium is present within the limit in all samples. Despite Potassium is found in less quantity in all samples and there is no limit mentioned by BIS it has effect on heart and brain .Chemical oxygen Demand(COD) is within the permissible limit in all samples.

5. Conclusion

Over alll,on the basis of resultssample no. 1 is better than sample no. 2 and 3. and sample no.3 is better than sample no. 2 Water of sample no. 2 and 3 require special treatment before use.

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