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RESEARCH ARTICLE

ANALYSIS OF METALLIC PROPERTIES OF DRINKING WATER AT DISTINCT PLACES IN DELHI REGION

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ABSTRACT

At this present time, unadulterated and pure drinking water has become a remedy of our life. At this extremely topical and applicable investigation, a study was conducted to study the gigantic effect of drinking water on an extensive area of society. For this purpose, samples of drinking water were tested from Municipal water supplies crosswise over 25 select areas of Delhi. WHO characterizes safe drinking water as that "which does not represent any critical hazard to wellbeing over one's lifetime of utilization, including certain unique and delicate phases of life" Contaminated water may imperil our wellbeing and disable our life quality. Water that is free from ailment causing microorganisms and destructive synthetic concoctions is named, consumable water", and might be securely devoured without the danger of prompt or long haul hurt. One of the strong impacts of the contaminated water is event of substantial metals. Which are destructive and poisonous at high fixations influencing oceanic creatures just as human life. The convergence of substantial metals like copper, lead, nickel, zinc and mercury were far in abundance of the breaking points endorsed by the Environment Pollution Act.

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INTRODUCTION

Water covers over 71% of the world's surface and is a vital normal asset for individuals (National Environment Research Council, 2007). However, just 2.5% of earth's water is new and accordingly appropriate for utilization. That, as well as of that 2.5%, more than 66% is secured away icy masses and not especially ready to help meet the developing requests of society (Ward, 2003). It is the central right of each person to get contamination free water. Water contamination influences drinking water, streams, lakes and seas everywhere throughout the world, which therefore hurts human wellbeing and the regular habitat (Sharda, 2013). With an explosion in the combined populace of urbanization and industrialization, the interest of water for expansive number of proposed utilizes has expanded complex as of late in India as well as all inclusive. This has prompted the water quality debasement of streams and lakes making the general shortage of drinking water (Sharda, 2013). Water of sufficient amount and quality is fundamental for economic advancement. Water quality performs critical job in soundness of human, creatures and plants. Water quality is the basic factor that impacts human wellbeing just as the amount and nature of grain creation in semi-damp and semi-dry zone (Kumar et al., 2013). Water contamination is destructive not exclusively to angle rearing

and farming items yet in addition to general wellbeing in encompassing region. Of the toxins, substantial metals can imperil wellbeing by being fused into natural way of life. Substantial metals are not biodegradable and will in general gather in the silt of conduits in relationship with natural and inorganic issue in the residue. Exorbitant supplements can prompt water eutrophication, causing a hypoxia situation, the decreases of species assorted variety and microbial development, mortality of benthic networks, and worry in fishery assets. Human exercises are a central point deciding the nature of surface and ground water through climatic contamination, profluent releases, and utilization of agrarian synthetic concoctions, dissolved soils and land use. These land use changes increment the measure of impenetrable surface bringing about tempest overflow occasions that adversely influence stream biological systems and water quality (Katayl et al., 2012). Substantial metals are cancer-causing to people (Sahu and Sohoni, 2014). Quick industrialization and resulting urbanization has prompted a few issues of water quality administration (United Nations Department of Economic and Social affairs). Water is an essential and fundamental asset forever bolster. It is utilized in a wide range of territories like for example water supply and sanitation, route, vitality generation, relaxation and diversion, farming and natural surroundings for sea-going life. With the developing populace, mechanical and social change, monetary development and the distinctive water accessibility in nations water has turned into a rare asset. Brief overflow and an escalated use lead to asset corruption. Creating nations hold fast to water deficiencies, as

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there is frequently an absence of wastewater treatment, bringing about critical water quality corruption results. In industrialized nations water pressure shows up that wastewater treatment, reusing of modern water, and so forth permits a concentrated reuse (Juneja and Chaudhary, 2013). Water is at the center of supportable advancement and is basic for financial improvement, solid biological communities and for human survival itself. It is essential for diminishing the worldwide weight of ailment and enhancing the wellbeing, welfare and efficiency of populaces. It is vital to the creation and conservation of a large group of advantages and administrations for individuals. Water is likewise at the core of adjustment to environmental change, filling in as the pivotal connection between the atmosphere framework, human culture and the earth (Atil *et al.*, 2012). Different offices, for example, the World Health Organization (WHO) and Centers for Disease Control (CDC) set introduction guidelines or safe points of confinement of synthetic contaminants in drinking water. A typical observation about water is that spotless water is great quality water demonstrating learning hole about the nearness of these substances in water. Guaranteeing accessibility and supportable administration of good-quality water is set as one Sustainable Development Goals (SDGs) and is a test for arrangement creators and Water, Sanitation and Hygiene (WASH) professionals, especially despite changing climatic conditions, expanding populaces, neediness, and the negative impacts of human improvement (Lalwani *et al.*, 2004). Water is a limited and crucial asset that is basic to human prosperity. It is just inexhaustible if all around oversaw. Today, more than 1.7 billion individuals live in waterway bowls where consumption through use surpasses normal energize, a pattern that will see 66% of the total populace living in water-focused on nations by 2025. Water can represent a genuine test to feasible improvement yet oversaw productively and impartially, water can assume a key empowering job in reinforcing the flexibility of social, monetary and natural frameworks in the light of quick and erratic changes (Xiandeng Hou *et al.*, 2000).

The accessibility of good quality water is a fundamental element for forestalling illnesses and enhancing personal satisfaction. Regular water contains diverse sorts of contaminations are acquainted in with oceanic framework by various routes, for example, enduring of rocks and draining of soils, disintegration of airborne particles from the air and from a few human exercises, including mining, preparing and the utilization of metal based materials. The inadequacy of the perfect water expands step by step due to over contamination and contamination of water (quick development of ventures) so the drinking water examination for physical, concoction properties are imperative fundamental for general wellbeing contemplates (Antony and Renuga, 2012). In numerous parts of the nation accessible water is rendered non-consumable due to the nearness of overwhelming metal in abundance. The circumstance gets declined amid the late spring season because of water shortage and rain water release. Sullyng of water assets accessible for family unit and drinking purposes with substantial components, metal particles and unsafe microorganisms is one of the genuine real medical issues (Praween and Fatima, 2015). Access to safe drinking water is vital to maintainable improvement and basic to sustenance generation, quality wellbeing and destitution decrease. Safe drinking water is fundamental to life and an attractive safe supply must be made accessible to buyers. Water is therefore turning into a pivotal factor for improvement and the personal

satisfaction in numerous nations (Reda, 2016). Very polluted water effectsly affects person, residential reason just as modern use. For example, people get influenced/tainted because of quality of various microbes and overwhelming metals present in water. It might influence the distinctive body organ and physiological issue. Hard water isn't appropriate for residential utilize, for example, washing, showering, cooking just as other reason. Hard water is additionally not appropriate for modern and farming use. It harms the sensitive apparatuses and influences the quality, solidness and gleam of the last item (Akter *et al.*, 2016). In Delhi, drinking water supply isn't from single source. Sixty eight percent of the populace is getting supply from water of Yamuna River. Ground water sources like cylinder wells, hand siphons and borings are alternate sources. To the extent quality is worried there is standard observing of physical parameters just. Suspended polluting influences, for example, metals are not checked. The greater part of the occasions ground water is specifically utilized. The present examination was expected to investigate metallic dimension in drinking water of Delhi.

METHODOLOGY

Material: Delhi's water and wastewater the executives are controlled by the Delhi Jal Board (DJB). Even though, Delhi is one of the principal Indian urban communities to have focused on city arranging with the main ace improvement plan of 1962, the framework for open utilities is turned out to be deficient, particularly under the weight of developing populace. Delhi has all out-region of 1486 sq.kms out of which completely created urban territories is 525 sq. kms. With more than 14 million occupants, the city is blasting at its creases. Populace of Delhi is required to achieve 17.5 million before the finish of the tenth Multiyear plan. Arranged on the banks of the waterway Yamuna, the city is fundamentally provided by surface water from the Yamuna, Ravi seas water (Bhakra stockpiling) and the Ganga water. The water accessibility from surface water sources, viz. Yamuna, Ganga and Bhakra frameworks are roughly 1150 MCM (million cubic meter), and of this 60 % is accessible from Yamuna waterway¹⁵.

Sampling: Appropriate examining is an imperative condition for right estimation of water quality parameters. Regardless of whether best in class systems and refined devices are utilized, the parameters can give an erroneous picture of the genuine situation because of ill-advised testing. The goal of testing is to gather delegate test. Test gathering is an imperative piece of water examine in light of the fact that ends drawn depend just on the testing of gathered examples (Christopher *et al.*, 2012). Agent test by methods an example in which relative extents or convergence of every single relevant segment will be equivalent to in the material being inspected. Besides, a similar example will be taken care of so that no huge changes in piece happen before the tests are made. The example volume will ideal little enough that it tends to be transported and sufficiently huge for scientific purposes.

Sample collection: Water samples were collected in 2-litres plastic cans sealed by screw cap along with the Cello tape to secure the leakage and labelled properly. The samples were collected from different areas such as Nagloi, New Ashok Nagar, Mayur Viah, Moti Nagar, etc. Preservations of samples were done as per the Standard Methods for the Examination of Water and Wastewater.

Table 1. Obtained concentration of Aluminum, potassium, sodium and zinc at various places out of 25 distinct places

Parameters	R K Puram	Karol bagh	Barakhamba	Shivaji stadium	Rohini west
Silver	BDL	BDL	BDL	BDL	BDL
Aluminium	0.01	0.03	0.02	0.13	0.13
Arsenic	BDL	BDL	BDL	BDL	BDL
Cadmium	BDL	BDL	BDL	BDL	BDL
Chromium	BDL	BDL	BDL	BDL	BDL
Copper	BDL	BDL	BDL	BDL	BDL
Potassium	9.02	1.02	2.11	18.92	12.99
Sodium	0.99	10.12	49.83	43.65	17.40
Manganese	0.00	0.00	0.01	0.00	0.00
Nickel	BDL	0.00	0.01	0.00	0.00
Lead	BDL	BDL	BDL	BDL	BDL
Selenium	BDL	BDL	BDL	BDL	BDL
Zinc	BDL	0.02	0.00	0.01	0.00
Iron	BDL	0.00	BDL	0.01	0.00

Table 2. Obtained concentration of Aluminum, potassium, sodium and zinc at various places out of 25 distinct places

Parameters	Naharpur	Jahagirpuri	Okhla tank	Uttam nagar	Patel nagar
Silver	BDL	BDL	BDL	BDL	BDL
Aluminium	0.02	0.21	0.02	0.02	0.48
Arsenic	BDL	BDL	BDL	BDL	BDL
Cadmium	BDL	BDL	BDL	BDL	BDL
Chromium	BDL	BDL	BDL	BDL	BDL
Copper	BDL	BDL	BDL	BDL	BDL
Potassium	1.13	45.68	2.11	4.12	56.39
Sodium	2.72	70.20	22.98	7.02	59.96
Manganese	0.00	0.00	0.01	0.00	0.01
Nickel	BDL	0.00	0.01	0.00	BDL
Lead	BDL	BDL	BDL	BDL	BDL
Selenium	BDL	BDL	BDL	BDL	BDL
Zinc	BDL	0.08	0.01	0.00	0.07
Iron	0.00	BDL	BDL	0.00	0.16

Analysis of samples: Inductively coupled plasma/optical outflow spectrometry (ICP/OES) is an incredible asset for the assurance of metals in a wide range of test frameworks. With this system, fluid examples are infused into a radiofrequency (RF)- initiated argon plasma utilizing one of an assortments of nebulizers or test presentation procedures. As an example for achieving the plasma is immediately dried, vaporized, and empowered through collisional excitation at high temperature. The nuclear discharge radiating from the plasma is seen in either a spiral or pivotal configuration, gathered with a focal point or reflect, and imaged onto the passage cut of a wavelength choice gadget. Single component estimations can be performed cost-successfully with a basic monochromator/ photomultiplier tube (PMT) blend, and synchronous multielement judgments are performed for up to 70 components with the mix of a polychromator and an exhibit finder.

The logical execution of such frameworks is focused with most other inorganic examination procedures, particularly concerning test throughput and affectability. Every one of the metals were broke down with the instrument named as Silver, Aluminum, Arsenic, Chromium, Potassium, Nickel and so forth. In straightforward words, substantial metals are synthetic components that have high thickness and are harmful at some explicit focuses. They are fit for entering our bodies by means of nourishment, water or air. Their poisonous quality can be legitimized by a wonder known as bioaccumulation. These substantial metals will in general aggregate inside the human body and they are put away quicker than they are separated. Living beings require distinctive measures of overwhelming metals. For e.g.: Fe, Cu, Mn, Mg, Mb, Zn are required by people. In any case, large amounts of such metals are harming to the life form (Christopher *et al.*, 2012).

RESULT AND DISCUSSION

The after effects of drinking water tests gathered from different areas were contrasted and the standard acceptable limits as per IS: 10500-2012 to examine whether the drinking water quality is in consistence with the standard, and subsequently, reasonable or not for the drinking purpose. 25 drinking water samples were collected from various areas of Delhi and examined for different metallic parameters. Heavy metals also exist and commonly found heavy metals such as Aluminium, Manganese, Zinc and Iron are found in all the sampling locations but some of the heavy metals are in some of the areas but not in all the sampling locations namely Nickel, whereas some are not in the range of detectable limit such as Silver, Arsenic, Copper, Chromium, Cadmium, Lead and Selenium. Sodium and Potassium are in the very high amount. All the results are given below in tables as per the obtained information-

All the water samples were examined via Inductively Coupled Plasma (ICP) instrumentation for detection of heavy metals. Water samples collected from various areas but in some samples collected from Karol Bagh, Shadipur, JahagirPuri, Patel Nagar etc. were found to contain higher concentration of heavy metals like Aluminum (beyond the acceptable limit that is 0.03 mg/L), Iron (Acceptable limit that is 0.3 mg/L), etc. (higher than the recommended permissible limit for safe drinking water as IS: 10500-2012) whereas in various areas the content of some of the heavy metals such as Cadmium, Arsenic, Chromium, Copper, Manganese etc. are below the detection limit as per the IS: 10500-2012. Increased concentration of heavy metal in water in some of the area could be due to high discharge of water from catchment area,

Table 3. Obtained concentration of Aluminum, potassium, sodium and zinc at various places out of 25 distinct places

Parameters	Akshardham	Shadipur	lit haus khas	Naraina	Dwarka
Silver	BDL	BDL	BDL	BDL	BDL
Aluminium	0.02	0.02	BDL	0.03	0.00
Arsenic	BDL	BDL	BDL	BDL	BDL
Cadmium	BDL	BDL	BDL	BDL	BDL
Chromium	BDL	BDL	BDL	BDL	BDL
Copper	BDL	BDL	BDL	BDL	BDL
Potassium	1.44	68.49	12.72	3.02	7.09
Sodium	4.04	99.93	48.85	8.38	8.24
Manganese	0.00	0.02	0.02	0.00	0.02
Nickel	BDL	0.00	0.00	BDL	0.00
Lead	BDL	BDL	BDL	BDL	BDL
Selenium	BDL	BDL	BDL	BDL	BDL
Zinc	0.01	0.01	0.03	0.07	0.03
Iron	0.02	0.84	BDL	0.02	BDL

Table 4. Obtained concentration of Aluminum, potassium, sodium and zinc at various places out of 25 distinct places

Parameters	Shubhash nagar	Anand parvat	Chawri bazar	Moti nagar	Mayapuri
Silver	BDL	BDL	BDL	BDL	BDL
Aluminium	BDL	0.10	BDL	0.13	0.04
Arsenic	BDL	BDL	BDL	BDL	BDL
Cadmium	BDL	BDL	BDL	BDL	BDL
Chromium	BDL	BDL	BDL	BDL	BDL
Copper	BDL	BDL	BDL	BDL	BDL
Potassium	4.21	18.99	13.21	1.72	2.04
Sodium	9.16	12.76	25.22	31.42	30.45
Manganese	0.00	0.03	0.00	0.00	0.00
Nickel	0.01	BDL	0.00	BDL	0.00
Lead	BDL	BDL	BDL	BDL	BDL
Selenium	BDL	BDL	BDL	BDL	BDL
Zinc	0.01	BDL	0.04	0.02	0.09
Iron	0.02	BDL	0.00	BDL	0.04

Table 5. Obtained concentration of Aluminum, potassium, sodium and zinc at various places out of 25 distinct places

Parameters	Mukjerjee Nagar	Lakshmi Nagar	Chatterpur	Nagloi	New Ashok Nagar
Silver	BDL	.p	BDL	BDL	BDL
Aluminium	0.03	0.01	0.01	0.01	0.00
Arsenic	BDL	BDL	BDL	BDL	BDL
Cadmium	BDL	BDL	BDL	BDL	BDL
Chromium	BDL	BDL	BDL	BDL	BDL
Copper	BDL	BDL	BDL	BDL	BDL
Potassium	13.35	10.56	7.54	6.21	9.00
Sodium	30.32	28.76	15.42	21.53	22.43
Manganese	0.01	0.00	0.00	0.00	0.00
Nickel	0.00	BDL	BDL	0.00	BDL
Lead	BDL	BDL	BDL	BDL	BDL
Selenium	BDL	BDL	BDL	BDL	BDL
Zinc	0.01	0.01	0.00	0.02	0.01
Iron	0.00	0.03	BDL	0.02	BDL

Table 6. Analyzed harmful toxins present in water as per IS: 10500-2012

S.No.	Parameters	Units	Acceptable Limit (As Per IS: 10500-2012) [Max.]
1	Silver (AS Ag)	mg/L	0.1
2	Aluminium (AS Al)	mg/L	0.03
3	Arsenic (AS As)	mg/L	0.01
4	Cadmium (AS Cd)	mg/L	0.003
5	Chromium (AS Cr)	mg/L	NA
6	Copper (AS Cu)	mg/L	0.05
7	Potassium (AS K)	mg/L	NA
8	Sodium (AS Na)	mg/L	NA
9	Manganese (AS Mn)	mg/L	0.1
10	Nickel (AS Ni)	mg/L	0.02
11	Lead (AS Pb)	mg/L	0.01
12	Selenium (AS Se)	mg/L	0.01
13	Zinc (AS Zn)	mg/L	5.0
14	Iron (AS Fe)	mg/L	0.3

industries and various drains where it is supplied after purification but might be purification is not of that capacity to accept that water for the drinking purpose. In this manner, to shield the nature of water from dangerous contaminations for the strength of people and the earth, two methodologies are by and large connected in the field of sustainable management to foresee the impacts of poisons and to screen the harmful toxins in water. All are given below in table No-6

Conclusion

Water is the valuable endowment of nature to individual and unadulterated water is a vital asset of humankind, since it is straightforwardly identified with human prosperity. Presently multi day's water will be contaminated step by step with expanding urbanization. Albeit three fourth piece of earth is being encompassed by water yet a little part of it might be utilized for huge purposes. In general it has been seen from the examination that the drinking water quality in the investigation territory is sensibly great and does not demonstrate any disturbing dimensions of metallic toxins, anyway it require some level of treatment before utilization as the centralization of the parameters, for example, Arsenic, Aluminum, Sodium, Potassium and so on are higher in a portion of the zone's with the goal that the people can be shielded from unfavorable wellbeing impact. It was diminishing and consoling that the Municipality treated drinking water supply crosswise over Delhi-NCR was observed to be of sensibly great quality, enough treated and we for utilization.

Ethical consideration: Na

Conflict of interest: Na

Source of funding: Na

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