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WATER QUALITY ASSESSMENT OF WATER TREATMENT PLANTS USED IN KANDHARI BEVERAGES PVT. LTD. SAMBA, JAMMU AND KASHMIR, INDIA

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ABSTRACT

"Water is life" is such a common expression that we use it almost as a cliché. Almost 71% of our earth is covered by water called as untreated water, and this water is not suitable for drinking purposes. The problem of fresh water deficiency is of worldwide impact. One of the solution to solve this problem is to treat the water by removing various toxic pollutants, contaminants, heavy metals or other organic or inorganic impurities that are present in water. This is done with the help of Water Treatment Plant (WTP). In order to study the Physico-chemical and Biological parameters of water used in the WTP of Kandhari beverages pvt. Ltd., the research work was carried out in which various parameters like pH, TDS, turbidity, total alkalinity, total hardness, free residual chlorine, appearance, odour and taste and other microbiological parameters were studied. These parameters analyzed were found to be mostly within the acceptable limit of water, while some of the parameters were found to be within the permissible limit of water as per the BIS standards followed by the industry.

KEYWORDS: *Water Treatment Plant, Alkalinity, Hardness, pH, TDS, Hardness*

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INTRODUCTION

Water is an inorganic, transparent, tasteless, odourless and nearly colourless chemical substance, which is the main constituent of earth's hydrosphere and the fluids of most living organisms. It is vital for all known forms of life, even though it provides no calories or organic nutrients. The density of water is 997kg/m^3 while as 18.01528 g/mol is its molar mass. In solid (ice) and liquid form it covers about 70% of the earth's surface. It is present in varying amounts as it constitutes about 92% of blood plasma, 80% of muscles tissues, 60% of red blood cells, and half of the other tissues. Water is elixir of life and two third of earth's surface is covered by it. Natural water is one of the most important substances for the maintenances of life.

The hydrosphere (from the Greek word "hydro" means "water", and "sphaira" means sphere) consists of major part of earth's surface. The hydrosphere is the aggregate of sea, ocean, and surface terrestrial water including lakes, streams, underground water and all the ice and snow (Khublaryan, 2009). Hydrosphere covers 71% of the earth's surface, of which only 1% of the world water is usable to us. About 96.5% of the planet's crust water is found in seas and oceans,1.7% in glaciers and the ice caps of Antarctica and Greenland, and 0.001% in the air as vapor, clouds (formed of ice and liquids water suspended in air), and precipitation . Only 2.5% of this water is fresh water, and 98.8% of that water is in

ice and groundwater. Less than 0.3%of all freshwater is in rivers, lakes, and the atmosphere and even smaller amount of the Earth's freshwater 0.003% is contained in biological bodies. Water is the vital resource for the life on the earth. We drink it, cook with it, wash with it, relax in it, fish with it, irrigate the plants,keep cool with it, produce energy with it and also use it for transportation and recreation (Satyanarayana et al,2013).

Beverage is the any drink or a liquid intended for human consumption. Common types of drinks include: - plain drinking water, milk, coffee, tea, hot chocolate, juice and soft drinks. And beverage industry is the industry that manufactures drinks. Beverage industry may vary greatly depending on which beverage is made. These are given as:

- Alcoholic beverages
- Non-alcoholic beverages

Alcoholic drinks include- wine, beer and liquor which contain the drug ethanol. While non-alcoholic drinks include: drinking water, juice, coffee, tea, hot chocolate, milk, soft drinks etc. This industrial report is solely on non-alcoholic beverages, their quality (control, analysis and assurance), production, marketing, and important parameters considered in a beverage industry.

Nowadays energy drinks are taking newer place in our market. The beverage products industry, viewed as an aggregate group, is highly fragmented. This is evident by the number of manufacturers, methods of packaging, production processes and final products. Most of the non- alcoholic beverage products inclde: coca cola, limca, sprite, thumsup, Maaza refresh, Maaza mango, fanta, kinley water, kinley soda, coke etc. These all products are assured by quality management departments by passing through the testing of number of parameters, hence making them a healthy drink for people.

Kandhari beverages is a coca-cola industrial complex of India. Kandhari group was established in 1967 by late Mr. Teja Singh kandhari. It is presently a progressive business house in India. KBPL is among coca-cola India's top franchisee bottlers and expanded its scope of operations to other Indian states including Punjab, Haryana, Chandigarh, Himachal Pradesh and Jammu. Presently KBPL has four operational manufacturing units at; Nabipur in Punjab, Baddi in Himachal Pradesh, Saha, Ambala in Haryana and one at Jammu in Jammu & Kashmir.

NEED OF WATER TREATMENT

As we are already aware that water is the priceless natural resource on the earth. As it covers much of the area of earth so its chance of deterioration is also very high. It leads to the water pollution. Water pollution may be defined as any undesirable change in the physical, chemical or biological characteristics of water that leads to adverse effects on the living beings. Thus water pollution leads to the need of treatment of water so to reuse the water again and again without the wastage of water. And also provides the treated water to the living beings, making them free from the impurities or contaminants so do not leads to any hazardous impacts for the life of living beings because water is a basic need for them to survive. Without water they can't even think to live. Here we have some causes that make water contaminated as well as their effects and its prevention.

Causes

- Detergents, chemicals and fertilizers in water from ground source.
- Pesticide, insecticides etc from soil
- Industrial waste like raw material, rejected material or other left over waste when mixed with water.
- Domestic or household waste mixed with water

Effects of contaminated water

- It leads to various diseases in humans when they drink contaminated water like typhoid, cholera, dysentery etc which may prove to be fatal if not treated.
- Water pollution leads to destruction of ecosystem. Because ecosystem is highly dynamic and a small change into it leads to a big change which may be disastrous.
- When contaminated water is taken by aquatic animals like fish it leads to the complete destruction of aquatic food chain

Prevention

- Water wastage is the global problem. So it is better to save or conserve water without wasting too much. Utilize water according to the need not to the deed.
- Treatment plant: there should be implementation of water treatment plants in industry as well as other places to treat the contaminated water so to utilize into specific products like water treatment plants (WTP), effluents treatment plants (ETP) etc in beverage or food industry.
- By using environment friendly products in industry we conserve water contamination.
- Awareness among peoples about the importance of water, its treatment and various water treatment plants.

Water Treatment plant (WTP)

Water treatment is the process of removing contaminants from household water and waste water. Clean water is essential for health, hygiene and productivity of our community. Water treatment is any process that makes water more acceptable for a specific end-use. The end-use may be drinking, industrial water supply, irrigation, river flow maintenance, water recreation or many other uses including being safely returned to the environment.

All surface and ground water require treatment prior to consumption to ensure that they do not represent a health risk to the user. However microbiological and chemical contamination is the most important to human health as this leads to infectious diseases which can proved to be fatal. Mahdi et al., (2007) studied a combined anaerobic - aerobic system for the treatment of textile industry waste water where he used cosmo balls for the growth of microorganisms in the anaerobic reactor Nitrification and de-nitrification processes is influenced by pH, DO and organic changes in the water. The results showed that 84.62% ammonia nitrogen and about 98.9% volatile suspended solid (VSS) removal efficiency is acquired. They concluded that the combined anaerobic-aerobic water treatment system was able to treat high strength textile wastewater. The maximum removal of ammonia nitrogen, BOD, COD, VSS were 84.62%, 63.64%, 60% and 98.9%

respectively. Fayza et al., (2004) conducted research on the chemical industrial wastewater treatment**.** This is recognised that the waste water from building and construction chemical industry is highly contaminated with organic matter while the waste water from plastic shoe industry is mixed with domestic waste water to reduce the organic load of water. They concluded at last that the characteristics or composition of waste water like toxicity, solubility, biodegradability etc responsible for a suitable water treatment system. Florante et al., (2009) conducted a study by using aerobic and an-aerobic reactors for the removal efficiency of nitrogen and organic matter of a lab scale system. They concluded that aerobic process requires longer aeration time and produces large amount of sludge but they can remove ammonium nitrogen. Anaerobic treatment methods usually offer advantages such as production of useful biogas; however includes some disadvantages like unable to remove ammonium nitrogen and having a high rate of effluent concentration. Bashaar (2004) studied a research on Wastewater from olive mills and pulp and paper mill industries in Jordan and their treatments using anaerobic and aerobic batch reactors. In both these waste water nutrients were not added. Valta et al., (2015) evaluated the wastewater management and water utilization in the food and beverage industry. Moreover these industrial sectors are responsible for various environmental issues like wastewater production, high level of water consumption and environmental pollution. Based on these issues their treatment plants are designed.

The study area Samba falls in the district Samba in the UT of Jammu and Kashmir. The district covers Samba town and adjoining tehsils: Vijaypur and village Supwal and Garhwal tehsil of Kathua. The district is separated from the Jammu district by "Purmandal Bridge". Samba is situated on the bank of Basantar River. Samba is located at 32.57°N 75.12°E and has an average elevation of 384 m (1,260 ft).

MATERIAL AND METHODS

The essential physical parameters of water are pH, Turbidity, TDS etc which can be determined by using the instruments like pH meter, turbidity meter and TDS meter respectively. The essential chemical parameters of water are total alkalinity, total hardness, free residual chlorine etc which are analyzed by titrations methods etc. Total plate count method, yeast/mould method and coliform are the methods of microbiological analysis of water. Appearance, odor, and taste (AOT) are the sensory analysis of water. The testing methods determine the quality of water from any filter tank of WTP and reached a specific conclusion according to the BIS specifications for standards methods of procedure (SM-PR) and KORE (coca-cola operating requirements) followed by industry as described below (Table 1).

Table 1: Water Quality Parameters and Analytical/Testing Methods Used in the Analysis of Water Samples

Parameter	Test Method	Reference
pH	SM-PR-355	BP-RQ-180
Total Dissolved solids (TDS)	SM-PR-445	BP-RQ-180
Turbidity	SM-PR-455	BP-RQ-180
Total Alkalinity(M-value)	SM-PR-040	BP-RQ-180
Total Hardness	SM-PR-460	Earlier BU/KORE
Appearance	SM-PR-441	BP-RQ-180
Odor	SM-PR-441	BP-RQ-180
Taste	SM-PR-441	BP-RQ-180

Microbiological Testing

The microbiological parameter was determined only for raw, treated, and soft water samples.

Total plate count (TPC)

It is the method for enumerating total plate aerobic bacteria. It can be made using Plate Count Agar.

Determination of Coliform Bacteria

The Media used for coliform determination was CCA (Chromogenic Coliform Agar)

Determination of Yeast and Mould

The Media used for yeast and mold determination was YGC (Yeast extract Glucose Chloramphenicol Agar Media).

RESULTS AND DISCUSSIONS

The water samples from WTP were tested and their limits were determined according to the BIS (Bureau of Indian Standards) specification. The samples whose values were beyond the BIS specifications were retreat.

In the present work, water samples were tested for physical, chemical, microbiological as well as sensory parameters.The results of the analysis provide information that can be used to make decisions or to provide re-assurance that conditions are as expected. The results obtained after testing the water samples from WTP are mentioned below (Table 2, 3, 4)

Table 2: Physical Parameters of Water Samples

Water Tank Sample	pH		TDS		Turbidity		Frequency of Testing
	Result (PPM)	LIMIT (PPM)	Result (PPM)	LIMIT (PPM)	Result (NTU)	Limit (NTU)	
Raw water tank	7.28	6.5-8.5	320	<500	0.3	0.3	Daily
Treated H_2O tank	5.77	4.9 minimum	154	<500	0.3	0.3	Every 5 hour
Soft water tank	7.65	6.5-8.5	342	<500	0.3	0.3	Every 05 hours
Dealkalizer tank	3.36	3-4.9	140	<500	0.3	0.3	Every 05 hours
Ultra filter	5.85	5- 6.5	136	<500	0.3	0.3	Every 5 hr
01 micron filter water	6.21	>4.9	162	<500	0.3	0.3	Every 5 hr

Table 3: Chemical Parameters of Water Samples

Water Tank Samples	Total Alkalinity		Total Hardness		Frequency of Testing
	Results (PPM)	Limit (PPM)	Results (PPM)	Limit (PPM)	
Raw water tank	286	<200	298	<100	Daily
Treated water tank	64	<85	80	<85	Every 5 hr
Soft water tank	42	<85	Nil	<10	Every 5 hr
Dealkalyzer tank	Nil	Nil	18	<30	Every 5 hr

Table 4: Results of Sensory Water Samples

Water Samples	Appearance	Odor	Taste	Frequency
Raw water tank	Normal	Normal	No off- taste	weekly
Treated H_2O tank	No visible colour	No off-odor	No off-taste	weekly
Soft water tank	Normal	No off- odor	No off- taste	weekly

These results clearly shows that the water supply for the manufacturing of beverages from WTP is free from any kind of contaminants, pollutants or toxicants as they are within the acceptable limits for drinking water. Most of the effluent wastewater pollutant contents are under limits of the EPA guidelines in the Beverage Industry in Ghana (**Agyemang et al., 2013).** Moreoever, the ability of the wastewater treatment plant to deal with pollutant such as COD, Ammonia and BOD shows that the treatment plant is efficient. **Cassano et al., (2015)** revealed that Membrane Technologies play an important role for the water treatment and reuse in the food and beverage industries. This gives an overview of membrane-based processes for water reuse and environmental control in the treatment of wastewaters from the food-processing industry.

In addition to the biological treatment, coagulation or flocculation process is the useful for the waste water treatment of beverage industry (**Amuda, 2007**). **Dhote et al., (2012)** explored that it is better in developing nations if low technology is mixed and matched with high treatment techniques of water. Furthermore they recognised variety of treatment techniques for the removal of contaminants like halogenated hydrocarbons, heavy metals, dyes etc from the water.

Hence industrial water would be suitable for fulfilling the industrial requirements for drinking water as per testing protocols followed by industry mentioned above in the methodology.

CONCLUSION

Water is the most essential natural resource on the earth and its conservation is necessary. The present study focussed on WTP (Water Treatment Plant) and the analysis of quality of water obtained from it. Various physical, chemical, microbiological and sensory parameters were tested.

Finally it is concluded that the water after treatment in WTP used in the industry were free from any hazardous pollutants and within the acceptable limits as per Indian standards of drinking water, used for human consumption. Water is the need of the hour, more it treated (by water treatment plant), more sustainable for future generation.

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