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Journal of Advanced Scientific Research

Available online through http://www.sciensage.info/jasr

ISSN
0976-9595
Research Article

Physio-Chemical Analysis of Sewage Water of Yamuna Nagar District of Haryana Before and After Treatment Using USAB

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ABSTRACT

The present study deals with the water pollution caused by sewage disposal and other effluents in Yamuna Nagar district of Haryana. This water is drained in Western Yamuna Canal which has its origin from pious Yamuna River and its subsidiaries which is harmful to aquatic life and is polluting the underground water of the region mainly in rainy season. The study of some physiochemical properties reveals that treatment of this polluted water is essential otherwise it will be a threat for underground water and aquatic life as well.

Keywords: Sewage, disposal, fresh water, reservoirs, surface water, water bodies.

1. INTRODUCTION

The history of human civilization reveals that water supply and civilization are almost synonymous. Several cities and civilizations have disappeared due to water shortages originating from climatic change. Millions of people all over the world particularly in developing countries are losing their lives every year from water-borne diseases [1]. An understanding of water chemistry is the basis of knowledge of multi dimensional aspects of aquatic environmental chemistry which involve the sources, composition, reactions and transport of water.

About 97% to earth's water supply is in the ocean which is unfit for human consumption and other uses because of its high salt content. The remaining 2% is locked in the polar ice caps and 1% is available as fresh water in rivers, lakes, streams, reservoirs and ground water [2] which is suitable for human consumption.

Water can be obtained mainly from two sources namely surface water and ground water. Surface water is any water that travels or is stored on top of the ground. This would be the water that is in rivers, lakes, streams, reservoirs and even the oceans. Rain water is probably the purest form of natural water, since it is obtained as a result of evaporation from the surface water. However in its downwards journey through atmosphere it dissolves a considerable amount of industrial gases like CO_2, SO_2, NO_2 etc and suspended solid particles both of organic and inorganic [3] origin. Rivers are the principal sources of water supply for many cities and towns. But the quality of surface water obtained from rivers is not reliable because it contains suspended matter and number of other impurities [4].

Sometimes, surface water sinks into ground and becomes ground water. The main source of ground water is rain water. A major part of rain water is absorbed into the earth. The absorbed water percolates into the earth and goes deep down the earth. Water beneath the surface comprises the next largest store of water [5]. Ground water and soil water together make up about 0.5% of all water (by volume).

Ground water flows through layers of sand, clay rock and gravel. It dissolves several minerals from the soil layers. The ground water appears clear due to filtering action of soil. Clean water is needed for drinking, cooking, bathing, washing, for sanitary disposal of domestic and human waste, for agriculture, for industrial processes as in production of material such as steel and other metals, paper, textiles, beverages, rubber, plastics, lather [6] etc. Water is one of the most essential substances needed to sustain human life, animals and plants. Although we as human beings recognize these facts but disregard it by polluting its different sources.

Today the accelerated pace of development, rapid industrialization and population density have increased water pollution at an alarming rate by adding numerous waste to water reservoirs [7].

Water pollution is the alteration in physical, chemical and biological characteristics of water which may cause harmful effects on man and aquatic biota [8]. Water pollution actually

represents the state of deviation from the pure condition where by its normal function and properties are affected. Any shift in the naturally dynamic equilibrium existing among environmental segments i.e. hydrosphere, lithosphere, atmosphere or sediments give rise to the state of water pollution.

Objectives of Waste Water Treatment

The waste water is finally disposed off usually in water bodies i.e. rivers, streams, lakes and oceans. The waste elements of waste water are then acted upon by the natural agencies of purification like air, sunlight, bacteria and other micro-organisms etc. and are ultimately assimilated by the water body. When the waste water to be disposed off is large in volume and strong in character, the purifying and assimilating capacities of water may not be sufficient. Then, these disposal agencies will get polluted and thus become useless for any other useful purposes.

This situation can be avoided by treating the waste water and reducing its strength [9] so that it can be made safe for satisfactory disposal. The waste water treatment plants, therefore, act as unloading stations where all the undesirable and nuisance causing elements [10] in the waste water are removed and the character of waste water is so altered that it can easily be accepted by disposal agencies without getting themselves degraded. Hence, waste water treatment plants supplement to the natural purifying power/capacity of the water bodies and help in maintaining their normal utilities [11].

2. MATERIAL AND METHODS

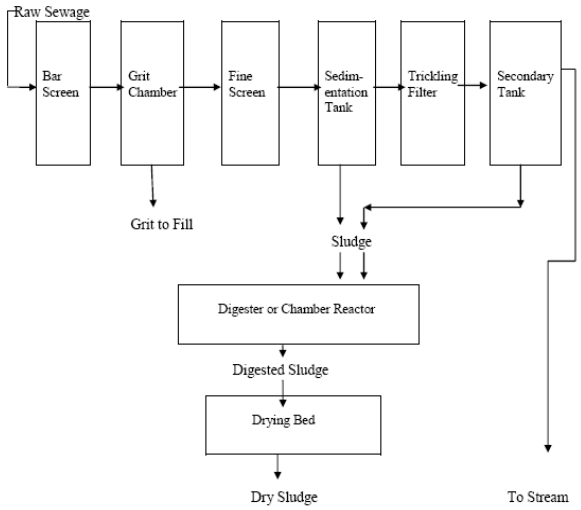
2.1. Study Area

Samples of sewage water from sewage treatment plants at camp and city centre, Yamuna Nagar were taken. The samples of sewage water before and after treatment were analyzed. Both the treatment plants use Upflow Anaerobic Sludge Bed (Blanket) Reactor (UASB) process for treating the sewage water. The capacity of treatment plants located at city centre and camp is 25 MLD and 10 MLD respectively.

Upflow Anaerobic Sludge Bed (Blanket) Reactor (UASB) Process

It is based on the settle ability of microbial flocks to produce a region at the bottom of the digester where very high biomass concentration can be maintained. The effluent is fed in the bottom of UASB into the base of the sludge blanket. The size of flocks varies from 1 to 5 mm diameter and should have good settling characteristics. The UASB process satisfies the urgent need of developing countries for simple low cost and integrated environmental protection system.

2.2. Typical flow diagram for treatment of raw sewage



Sewage water samples from above mentioned sites were collected and brought to laboratory for analysis. During the study, following parameters were investigated by usual methods.

i. pH using pH meter
ii. Acidity
iii. Alkalinity
iv. Free Chlorine
v. Total Dissolved Solids
vi. Free CO_2
vii. Total Hardness
viii. Temporary and Permanent hardness
ix. Dissolved Oxygen (DO)
x. Biochemical Oxygen Demand (BOD)

3. RESULTS

In order to ascertain the quality of sewage, it is subjected to number of tests. The results of these tests give an idea of the process of treatment of the sewage. The present study was undertaken to study the physio-chemical quality of sewage water samples which were taken from sewage treatment plant at camp and city centre, Yamuna Nagar. Samples from both the sites were collected before and after the treatment to study physio-chemical characteristics of sewage water. By treating the waste water, its strength is reduced so that it can be made safe for satisfactory disposal. The undesirable and nuisance causing elements in sewage water are removed and its character is so altered that it can be easily accepted by disposal agencies without getting themselves degraded. The characteristics of samples are studied before and after the treatment and results are compared with the standards.

Our observations on physio-chemical parameters of Yamuna Nagar sewage water have been described below under separate heading

Table 1: Summarized result of the study of physio-chemical characteristics of influent &effluent of site-1 &site-2

	Location	Site-1 (Camp)		Site-2 (City Centre)	
S. No.	Parameters	Influent	Effluent	Influent	Effluent
1	Colour	Dark black	Brownish black	Dark black	Brownish black
2	Temperature	22°C	23°C	22°C	24°C
3	pH	6.85	6.92	6.80	6.90
4	Acidity	38.3	34.1	36.8	33.6
5	Alkalinity	186.1	188.1	188.8	189.2
6	Total suspended solids	318	42	328	44
7	BOD	155	26	160	24
8	COD	320	70	310	75
9	CO_2 content	190	170	187	166
10	Total hardness	755.3	640.6	767.4	685.5
11	Permanent hardness	501.0	485.2	511.2	397.2
12	Temporary hardness	254.3	155.4	256.2	288.3

All values are shown in ppm except pH and temperature.

4. DISCUSION AND CONCLUSION

A number of physio-chemical characteristics viz. pH, acidity, alkalinity, total suspended solids, BOD, COD, CO_2 content and total hardness of untreated and treated sewage water were studied. The pH value of the treated sewage are found to be much within the range (5.5-9.00) specified by Central Pollution Control Board of India.

Acidity of the sewage discharge is brought down to lower values of 34.1 and 33.6 ppm after the treatment for safe disposal. The values of alkalinity show that alkalinity in sewage water after treatment comes out to be 188.1 and 189.2 ppm.

Total suspended solids in the untreated waste water are much higher (318 and 328ppm) and sewage treatment plants bring down these values to 42 and 44ppm which are much below the standard value of 100ppm.

BOD values of effluent of two sites come out to be 24 and 26 ppm which are much lower than 30ppm standard for the inland surface water discharge.

The present study shows that high values of COD i.e. 310 and 320 ppm gets reduced to 70 and 75ppm by sewage treatment which is well below the maximum limit of 250ppm as specified for safe disposal. CO_2 contents are also reduced by sewage treatment. The study shows that the comparative study of parameters like pH, total suspended solids, BOD and COD show that the sewage treatment plants of both the sites are working effectively by bringing down the values well below the maximum permissible values as specified by general standards for discharge of environmental pollutants.

It can be concluded that by treating the waste /sewage water and by reducing its strength, the sewage treatment plants are making the sewage water safe for satisfactory disposal. This also explains the necessity of such treatment plants and their maintenance from time to time.

5. ACKNOWLEDGEMENT

The technical help and valuable suggestions rendered by Prof Imre Toth, Professor Department of Inorganic Chemistry University of Debrecen are fully acknowledged by the authors.

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