Preliminary Treatment of Sewage Water a Case Study of City Nala, Quetta

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Abstract

From the past few years, Pakistan is facing the worst ever crisis of water shortage as the water availability for any use has become rapidly scarce even for the drinking purpose in some areas of Pakistan especially in Balochistan. The soaring demand of water for different domestic and commercial uses along with the scanty potable water resources, there is a need to store water and to introduce new water resources. The water which is considered unsuitable for human consumption becomes more significant in different commercial and construction uses.

As the resources of potable water are getting scarce, the raising demand of water constrain us to find out the different resources of obtaining water that would be usable for agricultural, commercial, construction and industrial purposes.

This study deals with the physical and chemical treatment of sewage water obtained from City Nala, Quetta. The treatment of sewage water (physical and chemical) was more focused interms of water quality parameters to introduce an alternative sources of economical water used in the concrete industry.

Keywords: Sewage water, filtered sewage water, treated filtered sewage water

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INTRODUCTION

The global potable water shortage is not concealed from any one. As reported by A. B More et al. (2014), 97 percent of the water is covered by the oceans, the remaining 3 percent is fresh water. Within this 3 percent only 1 percent is easily obtainable as ground or surface water and 2 percent are reserved as glaciers and icecaps. Water is the universal solvent and it cannot be extracted totally in pure form whether from any source, no matter how it is far away from the sources of pollutants, it will always have some chemicals. Minerals and gases in the soil, air and rock are solvated in the water. Pure water is normally considered as to be flat and tasteless but some dissolved minerals provides the water its characteristic taste.

Water that exists naturally, undergoes various physical and chemical changes, like any other material. The quality of groundwater that is percolated from deeper aquifers normally the rate is slower to change. Groundwater is not directly exposed to air pollution, it can become impure from run-off or wastewater discharge. By means of natural filtration the quality of groundwater is also protected, which can remove some impurities, as water percolates through the soils and rock. The impurities and minerals present in water are basically in small quantities and are measured in parts per million PPM that means how many parts of impurities and minerals in a million parts of water. It can also be measured in milligrams per litre (mg/l). These units can be used for both water and wastewater for finding out the minerals and impurities present in them. Sometimes the contaminants can also be measured in parts per billion (PPB).

SYED R. QUSIM (1985), WARREN VIESSMAN JR. & MARK J. HAMMER (1985), stated in their experimental study that the sewage water which is obtained from residence, business and institution buildings is known as domestic wastewater. This includes about 50 percent of the substances as organic matter and 50 percent as inorganic matter. This wastewater contains about 99.9 percent pure water and the rest includes suspended, dissolved and microorganisms which is bacteria, viruses, parasites etc.

JOO-HWA TAY & WOON-KWONG YIP (1987), studied the different quantities of reclaimed wastewater. The water was recycled through coagulation- flocculation, sedimentation, filtration, aeration and chlorination

The chemical water quality parameters of oily water and brackish water was analyzed by RAMZI A. TAHA et al. (2010), which included the total dissolved solids (TDS), chlorides, pH, hardness, alkalinity and sulphates, that were eventually used in the production of concrete and cement mortar samples.

Sources of Water Pollution

There are two major sources of water pollution which are given below,

1. Point source
2. Non-point source

1. Point source

The point source is also known as direct contaminant source and are those sources which directly discharge the pollutants into different water bodies and these includes the outfalls from the industries, factories, domestic wastes, refineries etc. Generally the domestic waste and industrial waste are considered to be the direct contaminant sources of water.

2. Non-point sources

The non-point source is also known as indirect contaminant source and are those sources which indirectly discharge the pollutants into different water bodies through environmental changes like from the atmosphere the contaminants enters the water supply through rain or the contaminants enters the water supply through soil.

MATERIALS AND METHODS

Preliminary Treatment of Sewage Water

The preliminary treatment of sewage water included the following processes.

1. Filtration
2. Addition of chemical

1. Filtration process

The filtration process of sewage water was followed by the conventional filtration method for which two plastic bottles and a cubical glass container were prepared. These plastic bottles and a cubical glass container were filled with washed char coal, clean stone dust (fine aggregate) and gravel in the following five different layers

- Gravel layer
- Fine aggregate layer
- Char coal layer
- Fine aggregate layer
- Gravel layer

The five different layers of sand, gravel and char coal was covered at the top and bottom by filter paper. At the bottom of the cubical glass container and bottles, an opening was provided for the collection of filtered sewage water

Figure 1a: Filtration Bottle Containers

2. Addition of Chemical

After the filtration process powdered hydrated potassium aluminium sulfate was added in the filtered sewage water for more purification. The amount of using the powdered alum in the filtered sewage water based on arbitrary method and was depended upon the pH of the filtered sewage water. From 1 to 3 percent powdered alum was used by weight of the filtered sewage water.

RESULTS

TESTS ON WATER QUALITY PARAMETERS

The following tests related to physical and chemical water quality parameters were conducted by Pakistan Council of Research in Water Resources (PCRWR)

1. Colour

Table 2: Analysis of Colour Parameter of Water

Sample	Standards	Permissive Limits	Results
SW	APHA*	Colourless	Objectionable
FSW	APHA	Colourless	Unobjectionable
TFSW	APHA	Colourless	Unobjectionable

2. Odor

Table 3: Analysis of Odor Parameter of Water

Sample	Standards	Permissive Limits	Results
SW	APHA	Odorless	Objectionable
FSW	APHA	Odorless	Objectionable
TFSW	APHA	Odorless	Objectionable

3. Taste

Table 4: Analysis of Taste Parameter of Water

Sample	Standards	Permissive Limits	Results
SW	APHA	Tasteless	Objectionable
FSW	APHA	Tasteless	Objectionable
TFSW	APHA	Tasteless	Objectionable

4. PH

Table 5: Analysis of pH Parameter of Water

Sample	Standards	Permissive Limits	Results
SW	WHO**	6.5 – 8.5	5.00
FSW	WHO	6.5 – 8.5	6.77
TFSW	WHO	6.5 – 8.5	7.07

5. Turbidity (NTU)

Table 6: Analysis of Turbidity Parameter of Water

Sample	Standards	Permissive Limits	Results
SW	WHO	5	256
FSW	WHO	5	204
TFSW	WHO	5	30

6. Total Dissolved Solids

Table 7: Analysis of TDS Parameter of Water

Sample	Standards	Permissive Limits	Results
SW	WHO	1000	1520
FSW	WHO	1000	1001
TFSW	WHO	1000	817

7. Alkalinity

Table 8: Analysis of Alkalinity Parameter of Water

Sample	Standards	Permissive Limits	Results
SW	APHA	NGVS	02
FSW	APHA	NGVS	08
TFSW	APHA	NGVS	10

8. Hardness

Table 9: Analysis of Hardness Parameter of Water

Sample	Standards	Permissive Limits	Results
SW	WHO	500	600
FSW	WHO	500	500
TFSW	WHO	500	500

9. Chloride

Table 10: Analysis of Chloride of Water

Sample	Standards	Permissive Limits	Results
SW	WHO	250	300
FSW	WHO	250	147
TFSW	WHO	250	138

10. Sulfate

Table 11: Analysis of Sulfate Parameter of Water

Sample	Standards	Permissive Limits	Results
SW	WHO	250	200
FSW	WHO	250	90
TFSW	WHO	250	90

*American Public Health Association

**World Health Organization

CONCLUSIONS

The physical treatment of sewage water was not just good enough for its further use. The quality of chemically treated filtered sewage water qualifies its usage for different purposes like agricultural, commercial, construction and industrial in terms of permissible water quality parameters as mostly the different physical and chemical water quality parameters were within the range provided by the standards. The addition of powdered hydrated potassium aluminum sulfate had a great impact on the different physical and chemical water quality parameters of filtered sewage water. The chemically treated filtered sewage water unveiled aesthetically pleasant appearance. The preliminary treatment of sewage water which included physical and chemical treatment did not qualify for utilizing it in drinking purposes in terms of water quality parameters as the taste and odour of these water samples were objectionable.

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