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Research Article

PHYSICO - CHEMICAL ANALYSIS OF TREATED WASTE WATER: A CASE STUDY OF DELAWAS AREA, JAIPUR (RAJ.)

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ABSTRACT
Due to scarcity of water and increasing population at an alarming rate reuse of treated waste water has become our present need. The aim of this study is to assess physico – chemical properties of waste water after secondary treatment. The water samples were collected from Delawas Sewage Treatment plant, Pratap nager, Jaipur. The study was carried out for a period of one year (2011 – 2012). Results revealed that pH varied between 7.80 to 8.35 and Electrical Conductivity between 0.64 to 1.16 mmhos/cm. Total solids from 687 mg/l to 910 mg/l. Calcium and Magnesium hardness ranged between 220 to 330 mg/l and 340 to 440 mg/l respectively. The Total Hardness was found between 560 to 770 mg/l. Chloride and D.O. values were between 155.60 to 262.70 mg/l and 4.3 to 6.0 mg/l. Alkalinity found between 740 to 830 mg/l respectively, heavy metals were also analyzed, from the results it was found that Cd, Cr, Ni and Pb were absent and Fe (0.118) and Cu (0.010) were present in very minute quantity. The treated water was found suitable for irrigational purpose.

Keywords: *Reuse, Sewage Treatment Plant, Secondary Treated Waste Water*

INTRODUCTION
Next to oxygen, water is the most important substance for human existence and it is essential for everything on our planet to grow and prosper (Prabu *et al.*, 2009). Water forms about 75% of the matter of earth's crust. Water is distributed in nature in different forms such as- rain water, river water, spring water, mineral water and saline water. It is also essential ingredient of animal and plant life, but today clean water is commodity and its quality threatened by numerous sources of pollution. Water is mostly used for industrial and municipal purposes.

In order to ensure the right quality and quantity of water for these purposes it is extremely important to monitor water supply through taking all the aspects into consideration (Sharma, 2005). Sewage is commonly a cloudy dilute aqueous solution containing mineral and organic matter. About 75% of water pollution is caused by sewage, domestic wastes and food processing plants.

It also includes human excreta, soap, detergent, metals, glass, rubbish garden waste and sewage sludge from cess pools etc. Domestic sewage and other wastes are thrown untreated or partially treated into the near bodies such as- ponds, lakes, streams and rivers. Since the dumping is uncontrolled especially near big cities, the water bodies are not able to recycle them and their self regulating capability is lost. If domestic waste or sewage is not properly handled after it is produced or if the effluent received at the end of sewage treatment plant is not of adequate standard, there is chance of water being polluted and this may lead to a number of serious problems.

Scarcity of safe drinking water is yet another burning problem in front of mankind. Reuse of sewage as irrigation water is one of the best option to reduce the stress on limited fresh water available today and to meet the nutrient requirement of crops.

But the use of raw or untreated sewage can cause accumulation of heavy metals in the soil and hence may cause phyto-toxicity (Malla *et al.*, 2007). When there is a shortage of water and the need for water is increasing with alarming rate, an attempt should be made to utilize the waste water to its maximum extent, without affecting the quality of human life. There are several places in India where the treated sewage water is being utilized for afforestation successfully.

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Study Area

Study area was confined to Delawas area of Pratap Nagar in the Jaipur district. There are two sewage treatment plants, having individual capacity of 62.5 mld. This treated water (after secondary treatment) is utilized in agricultural fields for crop production.

MATERIALS AND METHODS

For the present study the secondary treated waste water samples were collected from the of sewage treatment plant of Delawas area, Pratap Nagar Jaipur. These samples were collected during different periods of the year from October 2011 to September 2012.Water samples were collected in cleaned and washed glass bottles. The collected samples have been analyzed to determine their physico – chemical characteristics as pH, EC, TDS (Total dissolved solids). Total hardness, alkalinity, Calcium and Magnesium Hardness, Chloride and D.O. and estimation of metal ions were also done. The water samples, after collection were subjected to analysis following the procedure followed by APHA methods (1998).

Heavy Metal Analysis by Atomic Absorption Spectrophotometer

Atomic Absorption Spectrophotometer (AAS Model GBC 932) was used for analysis of heavy metals in water hollow cathode lamps were used for each heavy metal determination. The suitable volume of the sample was digested in di acid mixture of HNO3 and per chloric acid in the ratio of (10:1). The digestion was performed in 100 ml conical flasks and to facilitate complete digestion the samples in di acid mixture were kept overnight at room temperature. These flasks containing samples and di acid mixture were heated at hot plate until a clear solution was obtained. This was followed by a slow but complete evaporation of acids. Then, the volume of the digested samples was made up to 100 ml with the help of the double distilled water. These solutions were analyzed by Atomic Absorption Spectrophotometer.

Table 1: Physico-chemical analysis of water sample of Delawas sewage treatment plant (October 2011- September 2012)

S.No.	Parameters	Oct.-Dec. 2011	Jan.- March 2012	April-June 2012	July- Sept. 2012
1.	Colour & Odour	Pale Yellow & Odour Less	Pale Yellow & Odour Less	Pale Yellow & Odour Less	Pale Yellow & Odour Less
2.	Temperature	23^0C	25^0C	31^0C	27^0C
3.	pH	7.80	7.95	8.35	8.20
4.	EC (mmhos/cm)	0.64	1.07	1.16	0.93
5.	TDS(mg/l)	687	825	910	718
6.	Chloride(mg/l)	155.60	248.50	262.70	186.20
7.	Total Hardness(mg/l)	560	680	770	650
8.	Ca^{+2} Hardness (mg/l)	340	400	440	380
9.	Mg^{+2}Hardness (mg/l)	220	280	330	270
10.	Alkalinity(mg/l)	740	800	830	780
11.	DO (mg/l)	6.0	5.8	4.3	5.0

EC = Electrical Conductivity, TDS = Total Dissolved Solids, DO = Dissolved oxygen

Table 2: Heavy metal analysis of water sample of sewage treatment plant (October 2011-September 2012)

S. No.	Analyzing Period	Fe	Cu	Cd	Ni	Cr	Pb
1.	Oct.-Dec. 2011	0.118	0.010	-	-	-	-
2.	Jan.- March 2012	0.116	0.010	-	-	-	-
3.	April-June 2012	0.118	0.009	-	-	-	-
4.	July-Sept. 2012	0.118	0.010	-	-	-	-

WHO Standards of Heavy Metal

Fe	Cu	Cd	Ni	Cr	Pb
0.3	1	0.05	-	0.05	0.1

RESULTS AND DISCUSSION

The mean values of Physico-chemical characteristics of secondary treated waste water are summarized in Table 1. The Treated waste water pH varies from 7.80 to moderately alkaline 8.35. So, the pH range of this treated waste water is good for crop production because according to Wei *et al.,* 2005 Heavy metals are generally more mobile at pH < 7than at pH > 7. Electrical conductivity ranges from 0.64 mmhos to 1.16 mmhos, Total dissolved Solids varies from 687 mg/l to 910 mg/l. Chloride in treated waste water ranges from 155.60 mg/l to 262.70 mg/l, Total hardness ranges from 560 mg/l to 770 mg/l, Ca^{+2} hardness varies from 220 mg/l to 330 mg/l. and Mg^{+2} hardness from 340 mg/l to 440 mg/l. Total alkalinity ranges from 740 mg/l to 830 mg/l. Dissolved oxygen in water samples varies from 4.3 mg/l to 6.0 mg/l. Average concentration of heavy metal present in secondary treated waste water is presented in Table – 2. From the results, it is found that Cd, Cr, Ni and Pb are absent in Delawas Treated waste Water Sample and the average total concentration of Fe and Cu is 0.118 and 0.010 respectively, which is in permissible limit set by WHO.

Above results exhibit that Sewage Treatment Plant improved the Physico- Chemical properties of sewage waste water after its secondary treatment. Results also show that amount of most of the heavy metals present in treated waste water is negligible, only some heavy metals are present which are in very minute quantity e.g. Fe (0.118) and cu (0.010). Thus, this type of Sewage Waste Water Treatment plant can be considered as a good source of water for irrigation purpose that can also solve the problem of sewage waste water and scarcity of water which is a burning problem of our country.

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