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RESEARCH ARTICLE

TREATMENT OF WASTE WATER AND REUSE IN IRRIGATION SYSTEM

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Abstract

In water scarcity areas, reuse of waste water for agriculture or irrigation purpose is the better option to reduce water scarcity, increase crop yield and productivity. We filter the waste water with the help of sand filter, algae and screen filter. In present, quality of waste water was determined in September-October 2016 near Chhattisgarh Engineering College Risali Area Bhilai. The resulting value of hardness, acidity and alkalinity present in waste water is very high. Before filtration the corresponding values of hardness, acidity and alkalinity are 1057 mg/l, 37.5 mg/l and 175 mg/l. Waste water is filtered through handmade sand filter, algae and screen filter. After filtration the corresponding values of hardness, acidity and alkalinity are reduced to a great extent and the values are 510 mg/l, 7.5 mg/l and 115 mg/l respectively. High pH may cause yellowing of leaves, fungal attack and adversely effect on plant growth. High Calcium form white precipitate on soil surface. Pathogen present in waste water causes health hazards. If waste water is not properly treated it can produce some toxic agents. But some nutrients such as ammonia and nitrate are required for plant growth. It increases the crop yield. High concentration of chloride may cause toxicity problem in crop and reduce yield. Toxicity directly related to chloride toxicity result from accumulation of chloride in leaves and damage leaf of crop. Saline water or salt water reduce water availability to the crops due to this yield is affected. High calcium or sodium content of water reduces the rate at which water enters the soil.

Introduction:-

The amount of earth covered by water is 71.11% and percentage covered by land is 28.89% but only 3% of the water is fresh water rest is salt water[3-5]. Involvement of very high costs of remediation will make this process slow and therefore, it is essential that the contamination of water bodies is controlled rather than remediation[4]. Water resources are of great environmental issues and studied by a wide range of specialists including hydrologists, engineers, ecologists, geologists and geomorphologists[8]. Surface waters volumetrically hold only a small volume

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(0.3 percent) of the earth's total freshwater resources; they represent about 80 percent of the annually renewable surface and groundwater[10].

In arid area it is very important to use of water adequately for drinking, irrigation, domestic use and for animals. In arid region it s essentially and beneficially to reuse of domestic, sewage and rainfall waste water with the help of filtration process. These waste water may use for irrigation purpose. We use handmade sand filter, algae and screen filter for filtration of waste water. Sand filter available in market but its cost is very high. For construction of handmade sand filter masonry tank, screen, graded gravel and sand is required. The first step need to large tank put hole in the middle. Cover the hole with wire mesh screen. Above wire mesh screen add layer of gravel material. The purpose of the gravel layer is strengthening the filter substance and prevents sand mixing with water .Now fill the sand ¾ of the tank. In second tank, blue green algae are used for filtration purpose. Micro algae culture offers an interesting step for waste water treatment because they provide bio treatment[7]. After that in third tank screen filter is used to remove solid impurities like fine sand and dust from water. Excessive nutrients reduce quality and yield of crop and excess corrosion of equipment. When calcium and magnesium ratio increase in irrigation water which effect the clay dispersion and higher mineral dissolution rate. In the irrigation water slightly excess of boron reduce the yield and harmful for many crop. The aim of our study is to filter the waste water and converted into useful form for irrigation purpose. We check water quality parameter before and after filtration. With the reuse of waste water for irrigation we can reduce the environment pollution by avoiding direct discharge of waste water along with salt. Additional benefits include use of waste water and plant food nutrient for crop production.

Study Area:-

The sample of waste water was taken from stream near the Chhattisgarh Engineering College Risali, Bhilai Chhattisgarh, India. Location of study area mentioned in figure 1 and 2.

Figure 1:- Map of Chhattisgarh in India.

Figure 2:- Map of Chhattisgarh Engineering College and sample taken from near to this place.

Material and Methodology:-

We prepared treatment unit by using Sand or Algae which show in Figure 7 and 8. Then the sample of waste water is collected from stream in plastic bottle with care and transported to laboratory of Chhattisgarh Engineering College. Analysis of these water samples were using standard methods recommended by (APHA-AWWA-WPCF (1981) and Manual of water and waste water (APHA-AWWA-WPCF (1981)[1-2]. Standard method was used to determined water quality parameter. DO (Dissolved Oxygen) was used by Iodometric method. BOD (Biochemical Oxygen Demand) analyze using BOD incubator. pH was determined using pH meter. Total hardness evaluated from EDTA titration method using EBT (Eriochrom Black-T) or P & R indicators. Titration method was used to determined total alkalinity. TDS was measured by TDS meter. For determination of all parameters we used distilled water. After determination of all water quality parameters treat water by our sand filtration after treatment again check all water qualities parameters.

Table 1:- Water quality parameters of waste water sample and comparison with irrigation water standards.

S. NO.	WATER QUALITY PARAMETERS	UOM	STANDARD VALUES	BEFORE FILTRATION	AFTER FILTRATION
1	Total Solid	mg/l	<2000	2200	1500
2	TDS	mg/l	1300	1800	1300
3	Turbidity	NTU/JTU	-	32	8
4	Total Hardness	mg/l	600	1075	510
5	Calcium Hardness	mg/l	-	200	120
6	Mg Hardness	mg/l	-	875	390
7	Permanent Hardness	mg/l	-	975	420
8	Temporary Hardness	mg/l	-	100	90
9	Calcium	mg/l	-	80	48
10	Magnesium	mg/l	100-300	210	110
11	Acidity	mg/l	-	37.5	7.5
12	Chloride	mg/l	70-355	137.5	77.5
13	Methyl Orange Alkalinity	mg/l	-	175	115
14	Total Alkalinity	mg/l	80-100	175	115
15	BOD	mg/l	< 10	9.4	2.4
16	DO	mg/l	5 & 14.6	16	9.4
17	pH	-	5.5-6.5	7.8	6.5

UOM= Units of Measurement

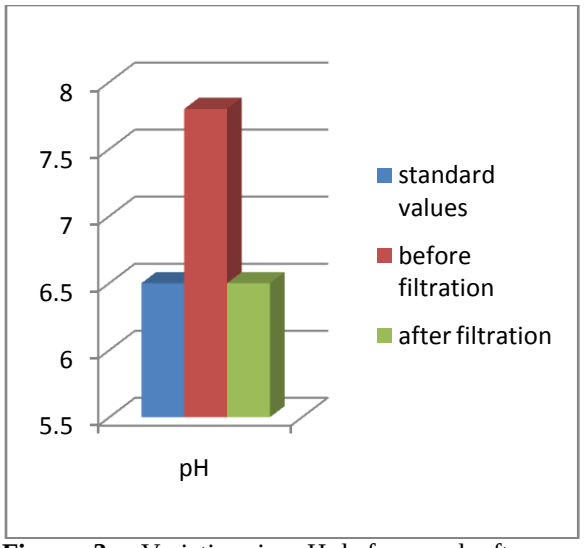

Figure 3:- Variation in pH before and after filtration

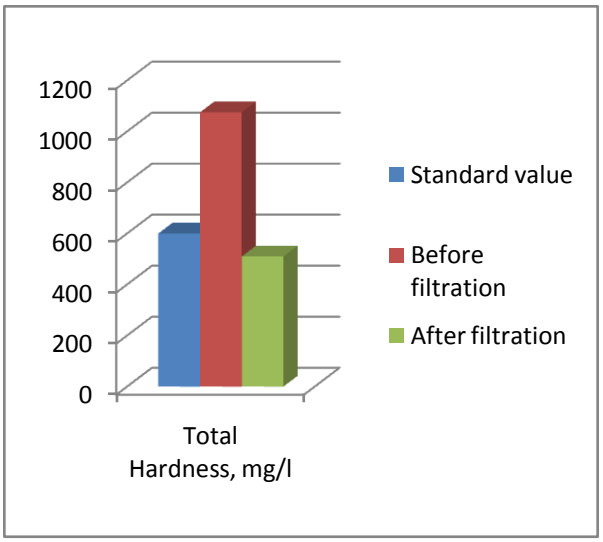

Figure 4:- Variation in Total Hardness before and after filtration

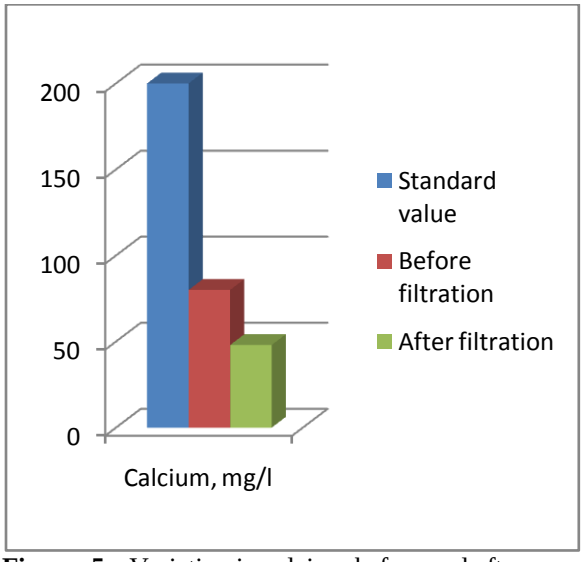

Figure 5:- Variation in calcium before and after filtration

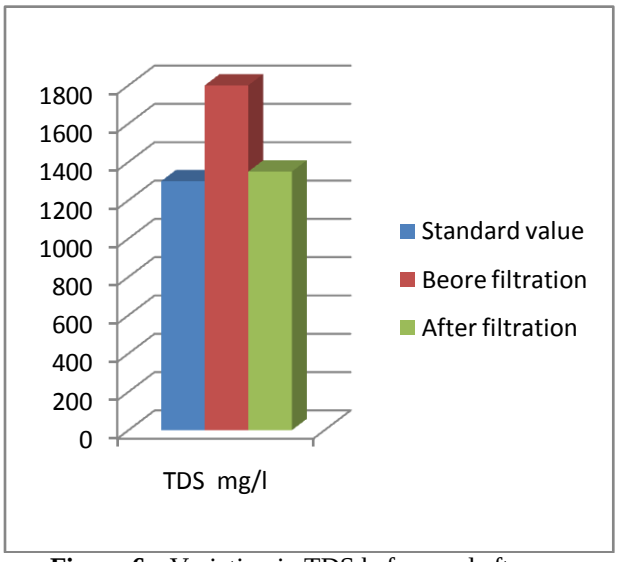

Figure 6:- Variation in TDS before and after filtration

Figure 7:- Sand filter

Figure 8:- Screen filter

Result and Discussion:-

The observed value of water quality parameter of waste water has been mentioned in Table 1 and compare with standard values. The value of acidity was found very high before filtration. It is danger for crop and soil. But filtration system reduces acidity from 37.5 to 7.5 mg/l. pH reduces from 7.8 to 6.5. Hardness was 1075 mg/l before filtration and 510 mg/l after filtration. Total alkalinity was found before filtration was 175 mg/l and after filtration 115 mg/l. Chloride decreases from 137.5mg/l to 77.5mg/l by treatment. Value of TDS reduces from 1800 mg/l to 1350mg/l. Value of Turbidity was 32 NTU before filtration and become 8 NTU after filtration. Amount of total solid decreases from 2200 mg/l to 1500 mg/l. High value of water quality parameter before filtration may cause of disease in crop but reduced values of these parameter after filtration shows that these water does not produce disease in plant.

Conclusion:-

The study shows that the after filtrations waste water suitable for use in irrigation purpose. Waste water is a rich source of nutrients and increase crop production and provides additional water for irrigation. It is highly beneficial in water scarcity area. It reduce fertilizer requirement. Effect of waste water on plant growth depends upon type of crops. But the use of unfiltered waste water is danger for human and crop. Excessive value of pH and acidity may cause of yellowing of leaves. The result also shows that the water is successfully filtered but use only for irrigation purpose not for drinking purpose.

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