

Treatment of Waste Water by the Process of Phytoremediation using Sunflower Plant

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Abstract - Phytoremediation is a process of removing impurities from the waste water using roots of a sunflower. To perform phytoremediation we have made a filter box having dimension 58cm × 38cm × 56 cm with an outlet of dia 7.6cm having perforated pipe partially inside the filter. Soil sample has collected at a depth of 25cm were excavated from **Dilkap College Campus, Neral, Maharashtra**. The filter bed consist of 5 layers in which the bottom layer consist of ballast of size greater than 35mm .2nd last layer consist of coarse aggregate of size greater than 10-20mm .3rd last layer consist of fine aggregate having size of 3-6.25mm .2nd layer consist of sand & top layer consist of red soil for the growth of sunflower. Using this filter box we are performing test for 2 sample of waste water. Firstly waste water will be taken to lab for their corresponding water test, after completing the test water will be poured on sunflower plants .Finally when the poured water comes through the perforated outlet pipe again these purified water tests are done through their respective lab to find **pH, Total Dissolved Solid, Biochemical Oxygen Demand, Chemical Oxygen Demand, Dissolved Oxygen** and hence results are compared with waste water and therefore we have to check wheather the following purified water can be used in our day to day life or construction, industrial purpose.

Key Words: Phytoremediation, Total Dissolved Solid, Biochemical Oxygen Demand, Chemical Oxygen Demand. Dissolved Oxygen, Red soil, Potential of Hydrogen (pH).

1. INTRODUCTION



Fig .1(a) Vertical filter bed



Fig .1(b) Vertical filter bed with sunflower plants

“Phytoremediation is defined as the use of living green plants for in-situ removal, degradation and containment of contaminants in soil surface waters and ground water.”

As we all know that heavy metals and contaminants that are present in waste water posses great environmental burden as they are hazardous to human, animals as well as plants and aquatic life. Also environment at a larger extent, therefore to avoid this threat we are introducing the process which is known as phytoremediation technique. Phytoremediation can be done through various plants and flowers such as Indian mustard, willow, poplar tree, Indian grass, sunflower etc. We are using sunflower as it absorbs large amount of impurities which are hazardous for soil. In this project we are using two different types of waste water therefore by using the technique of phytoremediation we are going to reduce impurities by finding the parameter like **pH, Total Dissolved Solid, Biochemical Oxygen Demand, Chemical Oxygen Demand, Dissolved Oxygen**. We are recycling the waste which will be available for industrial, construction purpose as well as agricultural purpose. Potential of sunflower for phyto extraction is low. Sunflower is a fast growing deep rooted industrial oil crop. So we used sunflower for phytoremediation technique.

2. MATERIALS AND METHODOLOGY

- As various types of plants can be used for phytoremediation. Sunflower plant is used for phytoremediation.
- Soil supporting is an important parts and parameters of phytoremediation technique. Red soil is used for growth of plants and for filtering the water at some extent.
- The coarse Aggregates of size greater than 10-20 mm of well graded sieve quality is used and fine aggregates 3-6.25mm.
- Sand is also used for filtration and retain heavy metal at some extent.
- To make soil porous small pieces of stone of size 2-3mm is mixed in the soil.
- PVC pipe is used for outlet of diameter 7.2cm.
- Ballast size greater than 35mm size is used so as to act as filters so to allowe passage of waste treated water.

2.1. Sample Preparation

- As the phytoremediation is a plant base technology, the succes of all parts and proceses of phytoremediation is inherently depended upon proper plant sections.
- Special plants used for phytoextraction process should be fact growing and having the ability to accumulates large quantities of metal contaminants in their shoot tissues.
- The researches Initially envisioned using sunflower plants treat waste of waters by passing through soil root zone at plants.
- The first of all the different size of aggregate is placed in tank size of 58×38×56cm including ballast in a layer depth.
- First the boulder layer is placed at the bottom of tank in varrying depth of 2-3cm layer is above which coarse aggregates layer are which of depth in between 5-10cm in layers and fine sand in between 2-3cm of layers with respect to volume and capacity of tank.
- The red soil dried in shallow and wide space in the absense of sunlight
- The special type of soil and red soil is mixed so to support sunflower plant roots well and to help in phytoremediation process.
- As the fertilizers are also mixed with the red soil for faster rate of growth of sunflower plants.

2.2. Working Process of Phytoremediation

- Phytoremediation is based on certain natural processes carried out by plant (sunflower plants) including:-

- Update of metals and certain organic compounds i.e. moderately water soluble $\log k_{ow}=0.5$ to 3 from soil and water.
- Accumulations or processing of this chemical contaminants via lignifications, volatilization, metabolization, mineralizations (transforming into CO_2 and water).
- Increase the carbon and oxygen content of soil around roots by promoting microbial and fungal activities through release of chemical and decay of root tissues. Capture of contaminants from waste water as a part of treatment

3. RESULT

3.1 Soil Testing

3.1.1. Core Cutter Test.

Observation Table :-

Sr No.	Observation	Determination number	
		Sample 1	Sample 2
1.	Core cutter number	1	1
2.	Internal diameter (cm)	10	10
3.	Internal height (cm)	13	13
4.	weight of empty core cutter (W1) gm	0.867	0.867
5.	weight of core cutter with soil (W2) gm	2.657	2.657

Calculation :-

1. Area of core cutter = $\left(\frac{\pi}{4}\right) \times 10^2 = 78.53$ sq cm.

2. Volume of core cutter = Area × height

= 78.53×13

= 1021.02 cubic cm.

3. Standard Temperature = 105 °c.

4. Density (ρ) = 1.371gm /cc.

5. Dry density(ρ_d) = 1.24gm/cc.

6. water content = 10.26%

3.1.2 Specific gravity by pycnometer test .

1. W1 = Empty wt pycnometer.
2. W2 = Empty wt pycnometer +wt of Soil.
3. W3 = Empty wt pycnometer +wt of Soil +Water.
4. W4 = Empty wt pycnometer +water .

Observation :-

1. W1 =0.656.
2. W2 =0.940.
3. W3 =1.717.
4. W4 =1.548.

Calculation:-

$$\text{Specific Gravity} = \frac{(w_2 - w_1)}{(w_2 - w_1) - (w_3 - w_4)}$$

$$= \frac{(0.940 - 0.656)}{(0.940 - 0.656) - (1.717 - 1.548)}$$

Specific Gravity = 2.4

3.1.3 To find void ratio :-

- $\rho_d = \frac{G \times \rho_w}{1 + e}$

$$1.24 = \frac{2.4 \times 1}{1 + e}$$

e = 0.93

3.1.4 To find porosity :-

- $n = \frac{e}{1 + e}$
- $= \frac{0.93}{1 + 0.93}$

n = 0.487

3.2 Waste Water Samples

3.2.1 Municipal Waste Water Sample :-

Sr.No	Test Parameter	Unit	Waste Water		Test Method
			Before Testing	After Testing	
1.	pH		5.64	7	Digital Ph meter model (EQ-610)
2.	Total Dissolved solid	NTU	42.1/20 40/200	21.1/20 21/200	Digital Nephelometer (Model LT-34)
3.	BOD 3 days at 27C	mg/L	9.0	3.0	IS:3025(P-44)1993
4.	COD	mg/L	32	12	IS:3025(P-58)2006
5.	Dissolved Oxygen	mg/L	5.0	5.2	IS:3025(P-38)1989

3.2.2 Industrial Waste Water Sample :-

Sr. No	Test Parameter	Unit	Waste Water		Test Method
			Before Testing	After Testing	
	pH		5.27	6.02	Digital Ph meter model (EQ-610)
	Total Dissolved solid	NTU	16/20 17/200	28.8/20 28/200	Digital Nephelometer (Model LT-34)
	BOD 3 days at 27C	mg/L	13	8	IS:3025(P-44)1993
	COD	mg/L	48	36	IS:3025(P-58)2006
	Dissolved Oxygen	mg/L	-----	1.3	IS:3025(P-38)1989

3.3 Graphical Representation Of Waste Water Parameters :-

3.3.1 Municipal Waste Water from Neral

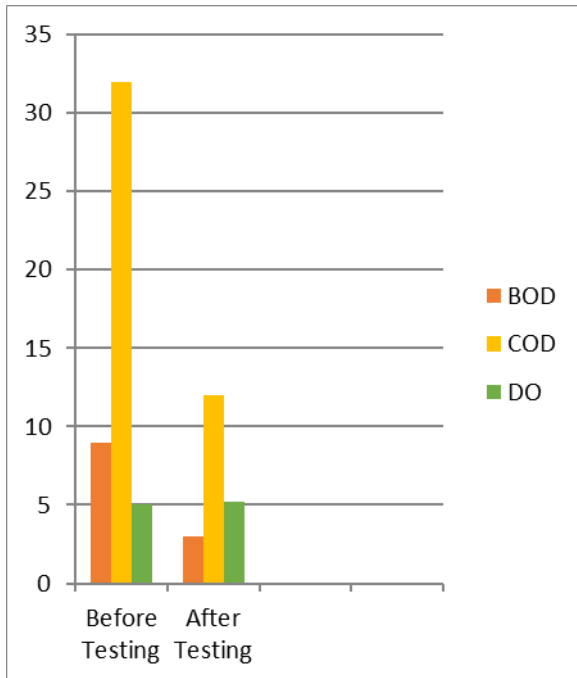


Fig :- 3.3.1 Municipal Waste water from Neral

3.3.2 Industrial Waste Water from Dombivali

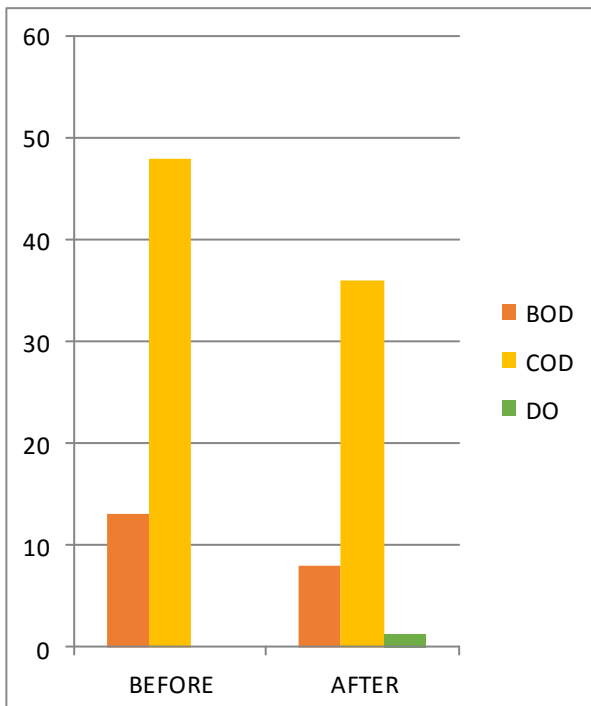


Fig 3.3.2 Industrial Waste Water from Dombivali

3.3.3 Graphical Representation for pH and TDS

3.3.3.1 Municipal Waste Water from Neral

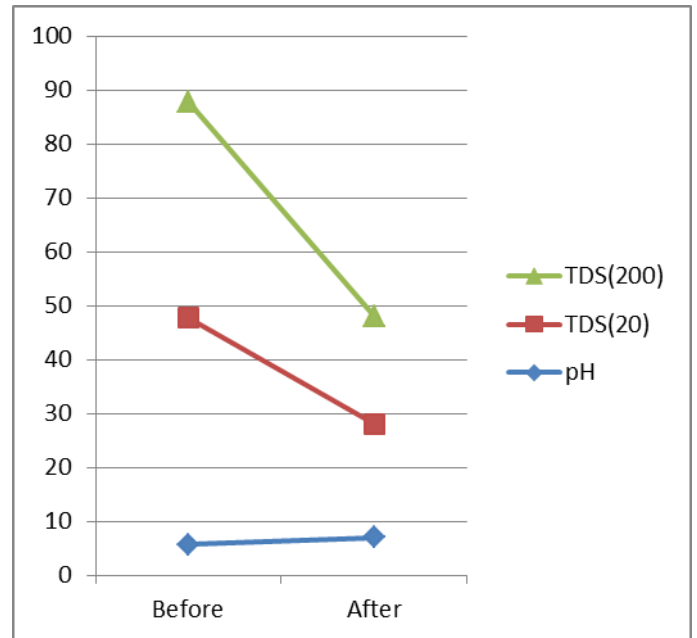


Fig 3.3.3.1 Municipal Waste Water from Neral

3.3.3.2 Industrial Waste Water from Dombivali

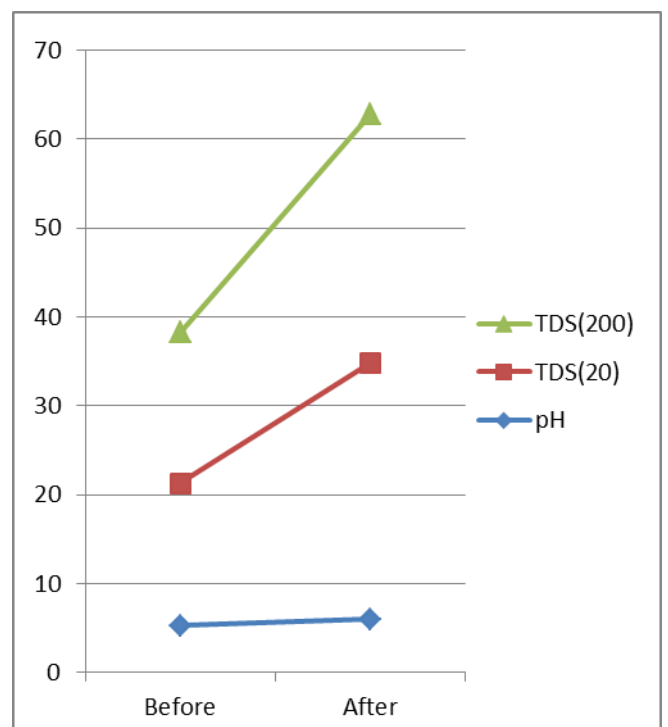


Fig 3.3.3.2 Industrial Waste Water from Dombivali

4. CONCLUSION

It was discovered by using vertical filter beds for treating waste water. Most of the impurities has been reduced to prescribed level by determining BOD ,COD , DO ,TDS &pH of waste water by making comparison between before and after treatment of waste water with the help of phytoremediating plants like sunflower .The reduction in impurities of waste water found out by the use of sunflower plants by knowing parameters such as BOD ,COD , DO ,TDS &pH .and after two different result comparing has been proven successful.Which makes the waste water able to reused for domestic and industrial purpose at some extent.

5. FUTURE SCOPE

While performing phytoremediation here were some difficulties that came across:-

- We have used red soil which has low tendency of low growth to sunflower.
- The growth of sunflower was less and that affects the detention period.
- Due to less detention period the purity of water differs.
- Water cannot be treated fully due to low detention period which indirectly affects the aim of our project.
- To increase the detention period try to grow more sunflower plants which helps in better results.
- The life span of the plant which we use is very short so it also affect on the result.
- Large number of plants are required so that huge number of roots are available to treat the waste water.

6. REFERENCES

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