Analysis Of Plant Growth And Water Treatment Using Hydroponics Setup

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Abstract—Hydroponics is a type of horticulture and a part of hydroculture which involve growing plants, generally crops, without soil, by using mineral and nutrient richsolutions in an aqueous solvent. Terrestrial or aquatic plants may grow with their roots suspended in the nutritious solution, or, in addition, the roots may be physically supported by an inert medium such as aggregate, coconut pith powder, gravel, or other substrates. Using Hydroponics system the treatment of domestic and laundry waste water, and growth of plants can be analysed.The plants used are spinach, Indian borage, thulsi etc. In hydroponics, during the plant growth the roots absorb the nutrients from the typical water used and progressively the waste water improves to a certain extend by decreasing its fatal characteristics, these waste water characteristics variations can be detected by taking the water sample and testing its BOD, COD, TSS, pH,TotalNitrogen,Total Alkalinity.

Keywords—Biological Oxygen Demand,Chemical Oxygen Demand, Domestic waste water,Hydroponics,Laundry waste water, Plant growth,Total Dissolved Solids,TotalNitrogen,Total Suspended Solids,Water Treatment.

1 Introduction

This document shows the water treatment and plant growth using hydroponics setup. Hydroponics is technique which the plant can growwithout-soil ,here water is used instead of soil.The domestic waste water and laundry waste water are used for the treatment.Plants like Spinach(spinaciaoleracea),Tulsi (ocimum sanctum linn),Indian borage (coleus amboinicus),Money plant (epipremnumaureum),Bringraj (Ecliptaprostrata),Curry leaf plant (murrayyakoenigi).After the water treatment ,water can be used for irrigation purpose.

Now a days the scarcity of water is more as compared to the past.So for irrigation purpose more water is needed.By using hydroponics, the treatment of waste water is done and that can be used for irrigation purpose. In urban areas cultivation of plants is difficult due to unfavarouble conditions like unsuitable soil type and lack of space. In such conditions hydroponics technique is adopted.

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2 Experimental setup

2.1 Materials

The materials required for the experimental setup are:

Aquarium, plywood, pots, aggregate, coconut pith powder, aerator, waste water(domestic and luandry) and plants Spinach (spinaciaoleracea),Tulsi (ocimum sanctum linn),Indian borage (coleus amboinicus),Money plant (epipremnumaureum),Bringraj (Ecliptaprostrata),Curry leaf plant (murrayyakoenigi).

2.2 Procedure

An aquarium of size 145cm×23cm×23cm is filled with waste water and it is covered with plywood (150cm×25cm×1cm) having suitable three holes with diameter of 9cm. Then pots are filled with aggregates and coconut pith powder instead of soil.The roots of plants should be suspended in waste water. An aerator is provided for the supply of oxygen .The experimental setup should be exposed to sunlight which is required for the growth of plants.

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3 WASTE WATER TREATMENT

3.1 DOMESTIC WASTE WATER

The domestic waste water is formed due to the household activities and it contains organic load from food processing, washing utensils in the kitchen, soaps and detergents.It mainly contains proteins, carbohydrates, oil and grease, detergents and other dissolved and suspended compounds.

The selected plants for the treatment of domestic waste water are Spinach (spinaciaoleracea),Tulsi (ocimum sanctum linn),Indian borage (coleus amboinicus) and the nutrients present in the waste water is absorbed by the plants then after15-20 days waste water get treated. The parameters like Biological Oxygen Demand, Chemical Oxygen Demand, pH ,Total Suspended Solids, Total Nitrogen are tested.

Fig.1 Domestic wastewater at initial stage

Fig. 2 Domestic wastewater at final stage

TABLE 1

TEST RESULTS OF DOMESTIC WASTEWATER

Parameters	Units	Standard limits	Test results	
			Initial	Final
pH	-	6.5-8.5	3.67	6.72
BOD	mg/L	10-30	1075	67
COD	mg/L	250	3754	230
TSS	mg/L	20	1012	33
TN	mg/L	20-30	125	0.85

The domestic waste water at initial stage which is shown in Fig. 1 and in this stage the water contains higher concentration of organic and inorganic components and the water is not much clear. The waste water also shows an unpleasant odour. A sample is collected and certain parameters were tested to understand the level of concentration in water as shown in Table 1.

The domestic waste water at the final stage which is shown in Fig. 2 and here the concentration is reduced and the waste water becomes clear after the treatment. The unpleasant odour in the waste water is completely disappeared.Sample is collected and the parameters which is shown in Table1 is tested

3.2 LAUNDRY WASTE WATER

Laundry waste water is formed during the washing of clothses. It contains suspended solids, salts, nutrients, organic matters.

The selected plants for the treatment of laundry waste water areMoney plant (epipremnumaureum),Bringraj (Ecliptaprostrata),Curry leaf plant (murrayyakoenigi)and the inorganic) and organic matter present in the waste water is absorbed by the plants then after15-20 days waste water get treated. The parameters like Chemical Oxygen Demand, pH, Total Suspended Solids, Total Alkalinity are tested.

Fig. 3 Laundry waste water at initial stage

Fig. 4 Laundry waste water at final stage

TABLE 2

TEST RESULTS OF LAUNDRY WASTE WATER

Parameters	Units	Standard limits	Test results	
			Initial	Final
pH	-	6.5-8.5	3.4	7.8
COD	mg/L	250	400	19.2
TSS	mg/L	20	182	7.4
TA	mg/L		362.1	106

The laundry waste water at initial stage is shown in Fig. 3 and in this stage the water contains higher concentration of organic and inorganic components and the water is not much clear and bubbles are visible. A sample is collected and certain parameters which shown in Table 2 were tested to understand the level of concentration in water.

The laundry waste water at the final stage is shown in Fig.4 and here concentration is reduced and the waste water becomes clear and bubbles are disappeared after the treatment. Sample is collected and the parameters shown in Table 2 which is tested.

4 PLANT GROWTH ANALYSIS

4.1 PLANT GROWTH IN DOMESTIC WASTE WATER

TABLE 3

PLANT GROWTH ANALYSIS

Name of plants	Measurements	
	Initial	Final
Indian Borage (coleus amboinicus)	12.6 cm	12.8 cm
Tulsi(ocimum sanctum linn)	15.7 cm	16 cm
Spinach(spinaciaoleracea)	12.4 cm	19 cm

Plants which are selected for the analysis in domestic waste water isSpinach (spinaciaoleracea),Tulsi (ocimum sanctum linn),and Indian borage (coleus amboinicus) .The growth of the plants occur by the absorbtion of nutrients present in the waste water. After 20 days of treatment the plant growth which is shown in table 3 and the plant growth is analysed.

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4.2 PLANT GROWTH IN LAUNDRY WASTE WATE

TABLE 4

PLANT GROWTH ANALYSIS

Name of plants	Measurements	
	Initial	Final
Money plant (epipremnumaureum),	49 cm	54 cm
Bringraj (Ecliptaprostrata)	19.5 cm	24.3 cm
Curry leaf plant (murrayyakoenigi)	22 cm	24 cm

Plants which are selected for the analysis in laundry waste water isMoney plant (epipremnumaureum),Bringraj (Ecliptaprostrata),Curry leaf plant (murrayyakoenigi) and the inorganic).The growth of the plants occur by the absorbtion of nutrients present in the waste water. After 20 days of treatment the plant growth is shown in Table 4 and the plant growth is analysed.

5 CONCLUSION

Thus the result of the experimental setup, in the first stage of treatment the domestic waste water is used. All the parameters like Biological Oxygen Demand, Chemical Oxygen Demand, pH ,Total Suspended Solids, Total Nitrogen tested reached the standard limits so then it is clear that the water get treated and also the growth of plants likeSpinach (spinaciaoleracea),Tulsi (ocimum sanctum linn),Indian borage (coleus amboinicus) occurred. In the second stage of treatment the laundry waste water is used. All the parameters like Chemical Oxygen Demand, pH, Total Suspended Solids, Total Alkalinity reached the standard limits so then it is clear that the water get treated and also the growth of plants likeMoney plant (epipremnumaureum),Bringraj (Ecliptaprostrata),Curry leaf plant (murrayyakoenigi) and the inorganic) occurred. So the analysis of plant growth and the treatment of waste water occured and it can be used for irrigation.

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