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Study on Use of Waste Water in Hydroponic System Instead of Nutrient Solution

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***Abstract:** Today, soil based agriculture is facing some major problem also decreasing per capita land availability. As well as water scarcity is major problem due to amount of water required is variable likewise, the water used for agriculture, industrial and domestic use. The earth covers 97.2% saline water and 2.8% fresh water only, the world population is increased day by day due to explosion of population we required more water supply and land for food requirement, therefore we need to recycle and reuse of waste water produce in our country. In sufficient capacity of waste water treatment and increasing sewage generation pose big question of disposal of waste water. In a India due to lack of sewage treatment plant, the 70% waste water diverted without treatment to the river and natural stream it create human health hazards. The soil degradation problem occurs while using the land for agriculture. Hydroponic technique is derived for facing those problems. It is a soil less culture in artificial environment in which plants are grown in nutrient solution without soil. The domestic sewage is also contain properties of nutrient solution, therefore it is possible to use sewage water in hydroponic system to grow plants, sewage water moving through plant root will be utilized this plant. It possible to reduce waste water parameter in hydroponic technique, the reduction in COD and BOD up to 50% is obtained from result.*

***Keyword:** Waste water, hydroponics, Sewage parameter, Low cost treatment, Plant cultivation.*

I. INTRODUCTION

Now a days, the environmental problems intensify steadily increased. They are rain isn't seasonal, outbreak and insect pests, soil degradation and climate change.

They have impact on the manufacturing agriculture. Environment problems have two aspects; the reduction of natural resources and degradation of environmental quality from the activities of human Pollutions caused by human action. This study used the wastewater for hydroponics.

It was combined the benefits in terms of crop production and wastewater treatment. Water pollution was due to chemical, fertilizer and animal waste that human dumped them into canal and rivers. Wastewater was important problem since a large quantity of water was used for product addition and utensil cleaning.

Such huge amount of organic pollutants in wastewater makes problems with its treatment when they are combined with municipal wastewater. The discharged volume of wastewater depends on the size of activities. The treatment of wastewater with less area requirement should be appropriate.

Cultivation with a defined nutrient solution, i.e. hydroponics, is sometimes differentiated from cultivation with a natural solution, such as wastewater, which is called bioponics or organic hydroponics. In this, the general term hydroponics is used as a definition for the technique to grow plants with roots emerged in wastewater The parameter are consider for testing of sewage is pH, Total dissolved solid, chemical oxygen demand , biological oxygen demand and The primary characteristic of inlet sample like nitrogen, phosphorus , potassium is measured .

In contrast to conventional wastewater treatment systems, hydroponic systems are associated with greenness, since the hydroponic system model are completely covered with green plants. In some country the plants are used for treatment of wastewater in wetland system. The sewage treatment plant is require more initial cost and maintenance cost therefore we require to design low cost technique.

II. OBJECTIVE

A. To study need of low cost technologies in wastewater treatment
B. To study of hydroponics technique for treatment of wastewater
C. To develop lab scale model of hydroponic system
D. To carryout performance for hydroponic system.
E. To study and analysis of waste water effluent.

III.METHODOLOGY

A.Experimental setup

The lab scale model of hydroponics system having NFT (Nutrient film technique) system. In which the sewage is passing through channel and the plant roots are dipped into sewage water. The tank is made by PVC material having dimension 1.4 x 0.9 x 0.45 m and outlet is at bottom side of tank. The semicircular channel having diameter 0.10 m is rested on tank by cutting the edges of tank in that shape. Thermocol sheet is used for supporting the plant and holes are make to sheet for fixing position of plant at specified distance. The cocopit is used as growing media wounded by the sponge to absorb the sewage nutrients .Pipe is used in that system having diameter 10mm and flexible to move. The One main pipe is connected to lateral pipe and connect to stopcock to control flow in channel outlet is provide at end of each channel .Also overflow valve is fitted at end of channel to control storage of water .The spinach and mint plant are selected to grow in hydroponic system having low life cycle .Pump used for carry sewage water having capacity 20 l/m and power 0.01 hp with plastic mesh is provided to avoid failure of pump.

Fig 1. Model of hydroponic system

B. Lab testing work

In the lab testing work chemical characteristics of sewage is measured it contain pH, TDS, COD, BOD.

Table 1.Testing parameter

Sr No.	Parameter	Method
1	pH	Digital pH meter
2	TDS	Gravity method
3	COD	Reflux method
4	BOD	Winkler method

IV.RESULT

A. Primary Characterization of sewage

Table 2. Primary characteristic of sewage .

Parameter	Reading	Unit	Permissible limit
pH	7.61	-	5.5 - 9.0
TDS	971	mg/l	100
COD	865	mg/l	250
BOD	370	mg/l	50
Nitrogen	84.6	mg/l	50

phosphorous	0.741	mg/l	10
Potassium	21.48	mg/l	30

B. Sewage parameter in hydroponic system

1) *pH :* The hydrogen ion concentration expressed as pH, is a valuable parameter in the operation of biological units. The pH of the fresh sewage is slightly more than the water supplied to the community. However, decomposition of organic matter may lower the pH. Generally the pH of raw sewage is in the range 5.5 to 8.0.

Table 3. pH

Sr. No.	parameter	Unit	Reading (days)					
			1	2	4	6	8	10
1	pH	-	7.61	7.90	7.95	7.87	7.68	7.52

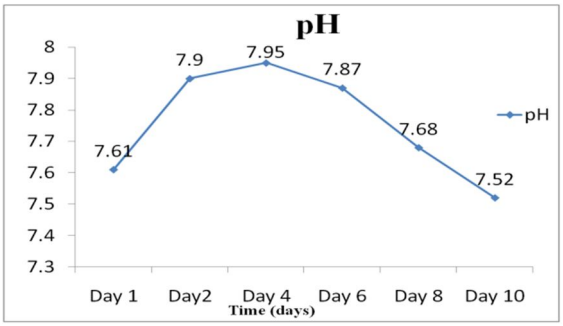

Fig 2.pH

From above graph we observed that pH of 1 to 4 days is increased simultaneously then again it reduced from 6 to 10 days, because of sewage is circulating continuously through the roots of plant in channel. pH is also depend on the concentration of sewage.

2) *TDS:* The total dissolved solids concentration can be related to the conductivity of the water, but the relationship is not a constant. The relationship between total dissolved solids and conductivity is a function of the type and nature of the dissolved cations and anions in the water and possible the nature of any suspended materials

Table 4. TDS

Sr. No.	parameter	Unit	Reading (days)					
			1	2	4	6	8	10
1	TDS	mg/l	971	853	726	668	592	522

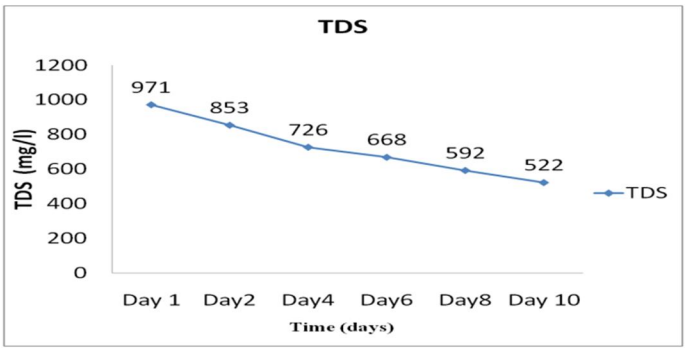

Fig 3. TDS

The total dissolved solids are measured in conductivity apparatus and converted by the formula. From above graph we seen that TDS is decreasing in 1 to 10 days testing of effluent. TDS is depend on Dissolved solid of water hence the TDS is constantly decreasing in hydroponic system through circulation of waste water. Also due to sludge settlement in the tank TDS is decreasing.

3) *COD:* Chemical Oxygen Demand or COD is a measurement of the oxygen required to oxidize soluble and particulate organic matter in water Chemical Oxygen Demand is an important water quality parameter because, similar to BOD, it provides an index to assess the effect discharged wastewater will have on the receiving environment. Higher COD levels mean a greater amount of oxidizable organic material in the sample, which will reduce dissolved oxygen (DO) levels.

Table 5.COD

Sr. No.	parameter	Unit	Reading (days)		
			1	5	10
			Initial		Final
1	COD	mg/l	865	522	370

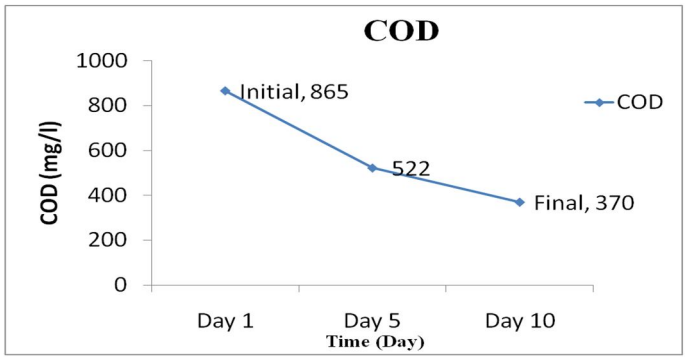

Fig 4. COD

From above graph we observed that , COD of sewage sample is high in initial stage and decreasing continuously upto 10 days of testing .The variation of COD is depend on the dissolved oxygen in sewage . The DO is increasing in sewage due to recirculation of sewage sample in channel to tank with help of pump, Therefore the COD of sewage is decreasing. The 42.77% COD removal is done.

4) *BOD:* Biochemical Oxygen Demand or Biological Oxygen Demand, is a measurement of the amount of dissolved oxygen (DO) that is used by aerobic microorganisms when decomposing organic matter in water.

Table 6.BOD

Sr. No.	parameter	Unit	Reading (days)		
			1	5	10
			Initial		Final
1	BOD	mg/l	370	320	180

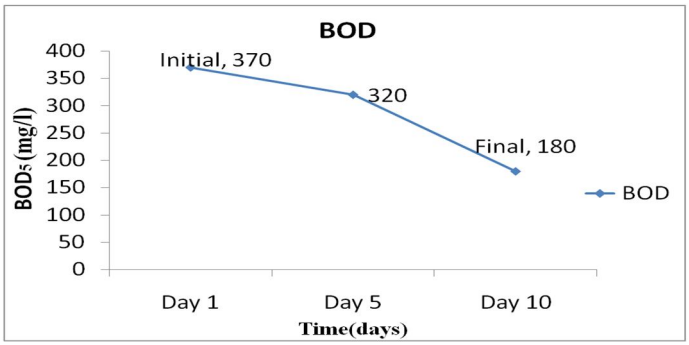

Fig 5. BOD

From above graph we observed that , BOD of sewage sample is high in initial stage and decreasing continuously upto 10 days of testing .The variation of BOD is depend on the dissolved oxygen in sewage . The DO is increasing in sewage due to recirculation of sewage sample in channel to tank with help of pump, Therefore the BOD of sewage is decreasing. The 48% of BOD removal is done .

C. Plant growth

The plant we selected for hydroponics system is spinach and mint . The growth of plant in 10 days recycling of sewage , plant uptake nutrients in sewage water like nitrogen , phosphorus, potassium .The plant growth is depend on concentration of sewage water due to variation in NPK content .The spinach plant is grow faster in hydroponics NFT system. Plant root can absorb nutrient from waste water, for photosynthesis of plant the sunlight is needed. The leaf of spinach affected by bacterial leaf spot due to presence of bacteria in waste water.

V. CONCLUSION

It is possible to reduce waste water parameter in hydroponics technique.The reduction in COD (42.77%) and BOD(48%) of waste water is obtained from test .System can be designed for individual houses to a cluster scale housing to community scale. The testing of hydroponic system in the form of hydroponic channels and wastewater treatment and reuse for rural areas.Treatment of domestic wastewater can be performed in a system combining microbiological processes and hydroponics.
Conventional pathwaysfor removal oforganic matter and nitrogen applies to the hydroponic system.The sludge production in the sys tem has been low. Very little sludge has accumulatedin the open tanks, and no sludge has been removed from system. A proposed r eason is the high sludge age, which increases the yield for degraded organic matter and biomass in a system.Before to supply the waste water to plant the primary treatment is essential .

VI. ACKNOWLEDGMENT

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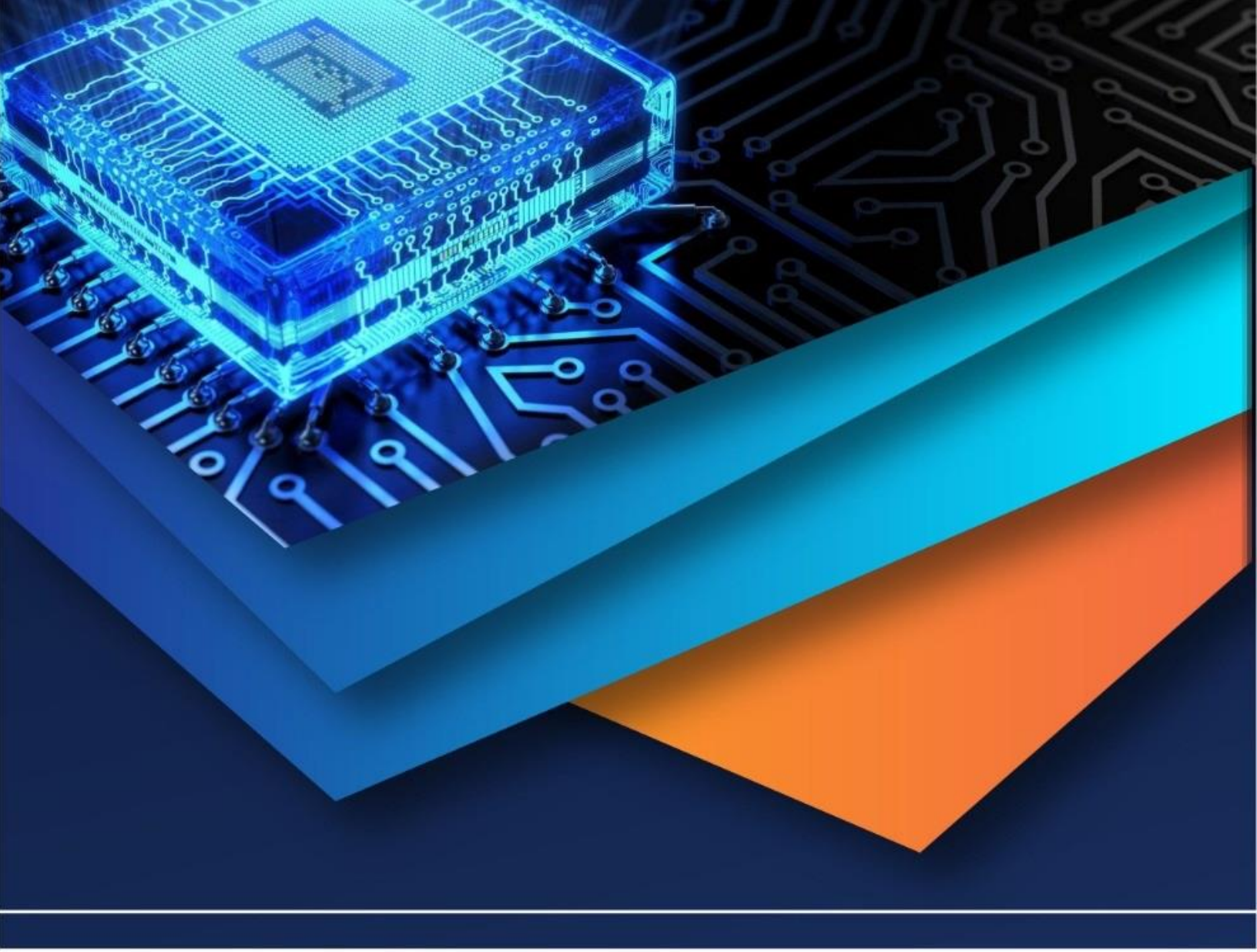

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