https://doi.org/10.46335/IJIES.2023.8.9.4 **e-ISSN: 2456-3463**
Vol. 8, No. 9, 2023, PP. 18-23

International Journal of Innovations in Engineering and Science, www.ijies.net

Use of Domestic Greywater for Hydroponic Farming: A Review

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***Received on**: 23 May, 2023* ***Revised on**: 19 June, 2023* ***Published on**: 21 June, 2023*

***Abstract** – An increase in population has led to the increase in consumption of food coffers and Generation of waste has also increased contemporaneously. From many times there have been noticed variations in the climate has also increased causing huge losses to the growers and dwindling the growth of the crops. Hence a need arises not only to use the coffers efficiently but also manage up for the unborn food security of the country. Hydroponics Farming has chased up helping in effective use of coffers and leading to an increased crop product. An attempt has been made to exercise domestic Greywater for Hydroponics husbandry. After studying the hydroponic husbandry system, we came to know that setup is one time cost but the regular recreating cost for this system is Nutrient water, which is generally expensive. As we know from the study that waste water (Greywater) is rich in nutrients. So then we're trying to study the feasibility of Greywater with minimum treatment as an alternative for nutrient water. A review has been offered to evaluate the efficiency of grey warter*
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Keywords: - Cost Effective, Greywater, Hydroponic Farming, Nutrient Water.

I-INTRODUCTION

An increase in population has led to the increase in consumption of food resources and generation of waste has also increased simultaneously. From a few years there have been noticed variations in the climate has also increased causing huge losses to the farmers and decreasing the growth of the crops. Hence a need arises not only to utilize the resources efficiently but also to cope up for the future food security of the country. Hydroponics Farming has coined up helping in efficient use of resources and leading to an increased crop production. Hydroponics is a way of crop manufacturing that has been correctly used for the increase of greens and flowers. It makes use of a nutrient answer and commonly managed environmental situations which makes it extra electricity intensive, but extra effective than traditional agriculture[1].Hydroponic is a technique of developing Vegetables and the usage of mineral solution, in water, without soil. This technique may be extraordinarily beneficial to international locations which have terrible land, which isn't always capable of preserving agriculture[2].

Hydroponics isn't a brand new practice; yet, it's far rather of a brand new technology. This way that the concepts at the back of hydroponics were round for years, however the take a look at it has simplest been round recently[2]. One of the Seven Wonders of the Ancient World, the Hanging Gardens of Babylon, became believed to have labored with a number of the standards which might be utilized in hydroponics[3].In India, Hydroponics changed into brought in 1946 through an English scientist, W. J. Shalto Duglas and he mounted a laboratory in Kalimpong area, West Bengal. He has additionally written a e book on Hydroponics, named as 'Hydroponics The Bengal System'. Later on all through the Nineteen Sixties and 70s, business hydroponics farms were advanced in Abu Dhabi, Arizona, Belgium, California, Denmark, German, Holland, Iran, Italy, Japan, Russian Federation and

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different countries. During the 1980s, many automatic and automated hydroponics farms were mounted across the world. Home hydroponics kits have become famous all through the 1990s[2]. Hydroponic structures were applied as one in all the same old strategies for plant biology studies and also are utilized in business manufacturing for numerous crops. The time period Hydroponics became derived from the Greek phrases Hydro' way water and ponos' way labor. It is a technique of developing vegetation using mineral nutrient solutions, without soil [4] . Terrestrial plant life can be grown with their roots withinside the mineral nutrient answer handiest or in an inert medium, consisting of perlite, gravel, or mineral wool[4] . Hydroponics is the approach of developing flora in soilless circumstances with their roots immersed in nutrient solution. Soil is commonly the maximum to be developed as a medium for flora. It offers anchorage, nutrients, air, water, etc. for a hit plant growth [5]. However, soils do pose extreme boundaries for plant increase too, at times. Presence of sickness inflicting organisms and nematodes, mistaken soil developing flora in soilless circumstances with their roots immersed in nutrient solution. Soil is commonly the maximum to be developed as a medium for flora. It offers anchorage, nutrients, air, water, etc. for a hit plant growth [5]. However, soils do pose extreme boundaries for plant increase too, at times. Presence of sickness inflicting organisms and nematodes, mistaken soil reaction, destructive soil compaction, negative drainage, degradation because of erosion etc. are a number of them[6]. In addition, traditional crop development in soil is fairly tough because it calls for big space, lots of exertions and a big extent of water. Moreover, a few locations like metropolitan soil aren't to be had for crop development at all, or in a few areas, we discover shortage of fertile cultivable arable lands because of their detrimental geographical or topographical conditions [4]. Of late, another serious problem experienced since is to higher labor for working in open field agriculture [4]. For many aspects, hydroponic culture can be utilized successfully. This way helps to face the problems coming from climate change and also sufficiently perform in production, thus effective use of natural resources can be done[7]. Within the plant studies community, several hydroponic structures were designed to observe plant responses to biotic and Abiotic stresses [7].

II- NUTRIENT WATER

NUTRIENT SOLUTION FOR PLANTS & HYDROPONIC SYSTEM.

Hydroponic structures may be used as a remedy method for in part treated wastewater or reclaimed water (RW) earlier than its launch to the environment, as vegetables have the capacity to uptake nutrients, poisonous metals and rising contaminants[8]. The nutrients wanted for the increase and improvement of vegetables are C, O and H, which might be received via air and water, and N, P, Si, B, K, Ca, Mg, Cl, Mn, Na, Fe, Zn, Cu, Ni) and Mo received from the soil [9]. Common fertilizers implemented to the soil comprise N, P, K and Ca as culturally they had been taken into consideration important to the increase of flowers [10]. In addition, because of the awful control of agricultural soils (i.e. adjustments in soil structure, monoculture, deforestation), lots of those nutrients won't be present [11]. Therefore, the global use of fertilizers has extended from 50 million tons (Mt) in 2008 to two hundred Mt in 2018 [10], regardless of that, vegetation simplest use 1/2 of the brought fertilizers and the relaxation facilitated to floor and groundwater [9].

III- LITERATURE REVIEW

The reuse of treated greywater for landscaping or forage manufacturing alleviates the call for water assets and decreases the stress on wastewater remedy flowers. However, thinking about the arguable findings of preceding research on greywater first-rate (especially, long-time period reuse), the reuse of treated greywater wishes to be taken into consideration with warning and periodic first-rate analyses and monetary checks are required [12 Greywater represents 50% to 80% of the full quantity of wastewater everywhere in the world. This overview gives numerous factors associated with greywater, which include origins, characteristics, and present tips for greywater right remedy and reuse. Several procedures and strategies had been advanced to have a look at the overall performance of various greywater remedy systems[13 Greywater represents 50% to 80% of the full quantity of wastewater everywhere in the world. This overview gives numerous factors associated with greywater, which include origins, characteristics, and present tips for greywater right remedy and reuse. Several procedures and strategies had been advanced to have a look at the overall performance of various greywater remedy systems[13].Soil primarily based totally agriculture is now dealing with numerous demanding situations which include urbanization, herbal disaster, weather change, indiscriminate use of chemical

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compounds and insecticides that is depleting the land fertility.Commercially Nutrient Film approach has been used all through the arena for success manufacturing of leafy in addition to different greens with 70 to 90% financial savings of water. Leading nations in the hydroponic era are Netherland, Australia, France, England, Israel, Canada and USA. For a hit implementation of industrial hydroponic era, it's far critical to increase low fee strategies which can be clean to perform and maintain; calls for much less exertions and decrease typical setup and operational fee[14]. Hydroponic System, clean *and*
additionally appropriate for monitoring. Maintaining minerals in soil isn't always clean and exam of soil productiveness is likewise tough, however withinside the Hydroponic System it is straightforward to handle[2]. Today, to conquer the multi-manifestations of weather change, clean water scarcity, and urgent want of the developing meals call for, Hydroponics, a soilless cultivation era, guarantees to offer excessive first-rate, healthy, clean, residue loose greens and culmination locally[15]. a glasshouse test to look at the growth, water and nutrient use of tomato (Lycopersicon esculentum Mill. cv. Grosse Lisse) the use of faucet water (TW), laundry greywater (GW) and answers of low and excessive awareness of a detergent surfactant (LC and HC, respectively) as irrigation remedies. Whole-plant awareness became measured for 12 crucial plant nutrients (N, P, K, Ca, Mg, S, Fe, Cu, Mn, Zn, Mo and B) and Na (regularly taken into consideration as a useful nutrient). Irrigation remedies affected the awareness of 4 nutrients (P, Fe, Zn and Na) and uptake of 7 nutrients (P, K, Ca, Mg, Na, Fe and B) significantly. Uptake of those seven nutrients with the aid of using tomato became usually withinside the order GW $\geqslant$ TW > HC $\geqslant$ LC. GW irrigated flowers had the best awareness of P, Na and Fe which had been 39–85% better than the TW irrigated flowers. Compared with faucet water irrigated flowers, greywater irrigated flowers eliminated 6% extra B, however considerably more portions of Na (83%) and Fe (86%). These consequences advocate that laundry greywater has a promising capability for reuse as irrigation water to develop tomatoes [16].

IV-GREYWATER HYDROPONIC FARMING

Ever since the Agricultural Revolution of 10,000 BC, humans have been growing food by planting seeds in the ground[17]. This has sustained the populace correctly for the remaining numerous millennia, however this isn't always to mention the gadget is unfastened from limitations that farmers have continually battled with. Hydroponics is a surprisingly latest innovation which requires us to incredibly reconsider the whole thing we assume we recognize approximately what farming has to appear like. It proposes the paradigm shift that vegetation now no longer really needs soil to thrive - they simply want a substrate which can supply the vital nutrients and water they want to grow. As it turns out, the hydroponic structures bring numerous benefits, and may be the manner humanity feeds itself for hundreds of years to come.

In order to increase the economical usage of natural and available resources and land, a project to study Feasibility of Domestic wastewater (Greywater) in Hydroponics Farming is made which includes needs, methods and types of Hydroponics Farming. As Hydroponics Farming is Expensive, an attempt has been made to economize the overall cost of Hydroponics farming by inclusion of wastewater (Greywater) or reclaimed water as nutrient water instead of using expensive packaged nutrient rich water [1]. An attempt is made to check the Feasibility of using Domestic wastewater (Greywater) and make this Farming system cost-effective. Waste water (Greywater) produced due to mortal conditioning in homes is called domestic wastewater i.n. wastewater from the kitchen, shower, marshland receptacle, restroom and laundry. The strength and composition of the domestic wastewater (Greywater) changes on hourly, diurnal and seasonal basis, with the average strength dependent on per capita water operation, habits, diet, living standard and lifestyle.[18]

V-TYPES OF TESTS

a. Total Coliform
b. pH
c. Turbidity
d. Color
e. Odour
f. Total Dissolved Solid (TDS)
g. Fluoride
h. Total Hardness
i. Calcium
j. Magnesium
k. Sulphate
l. Nitrate
m. Sodium
n. Iron

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o. Chloride
p. Chemical Oxygen Demand(COD)
q. Biochemical Oxygen Demand(BOD)
r. Dissolved Oxygen(DO)
s. Phosphorous

VI- METHODOLOGY

All the below methodology will be used throughout the preject with higher efficiency.

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- Collection of sample (Greywater)
- Plain Sedimentation of Sample
- Jar test for Optimum Value of Coagulant.
- Testing of Sample via Anacon Laboratory, Nagpur
- Comparison of parameters: Greywater and Nutrient water
- Model for Hydroponic Farming
- Growth rate in soil and hydroponic system
- Comparison between the output from soil and hydroponic farming.
- Hydroponic Model
- Comparison of Product

VII -TESTING OF SAMPLE

Sample was sent for the testing at ANACON LABORATORIES (Analytical Water Laboratory), Butibori, Nagpur. Tests like Physical parameters: Turbidity, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), pH Value and Chemical parameters: Chemical Oxygen Demand (COD),

Biological Oxygen Demand (BOD), Chlorine, nitrate, Phosphorus, Calcium, Dissolved Oxygen and Microbiological parameters like Total Coliform Bacteria and E-Coli Bacteria test was also carried out. Above all the tests have been performed after treating Greywater with Alum Coagulant. The optimum dose of coagulant is derived by performing a Jar test.

Table 1:.Nutrients Absorbed By Plant In Hydroponic Farming [19]

ELEMENT	IONIC FORM ABSORBED BY PLANT	COMMON RANGE
Nitrogen	Nitrate NO3	100 – 250
		ppm
	Ammonium NH4+	100 - 250 ppm
Phosphorus	Dihydrogen PhosphateH2PO4+	30 - 50 ppm
	Phosphate PO43-	30 - 50 ppm
	Monohydrogen Phosphate HPO42-	30 - 50 ppm
Potassium	Potassium K+	100 - 300 ppm
Calcium	Calcium Ca2+	80 - 140 ppm
Magnesium	Magnesium Mg2+	30 - 70 ppm
Sulphur	Sulphate SO42-	50 - 120 ppm
Iron	Ferrow Fe2+	1 - 5 ppm
	Ferric Ion Fe3+	1 - 5 ppm
Copper	Copper Cu2+	0.04 - 0.2 ppm

Table: 2 Accepted and Usual Range of Irrigation Water

Irrigation Water Characterization	Expected Range
Nitrogen mg/l	Nitrate NO3, 5-30
	Ammonium NH4+ , 0-5
Phosphorus mg/l	Phosphate, 0-2
Potassium mg/l	Potassium K+ , 0-2
Calcium mg/l	Calcium Ca2+ 0-20
Magnesium mg/l	Magnesium Mg2+ 0-5
Sodium (SAR)	3-9

VIII - COLLECTION OF SAMPLE

Sample of Greywater was being collected from the nearby building having two pipe systems. Sample was collected from the chamber which had Greywater with the help of a funnel. We collected around 3 liters of water for testing as well as trying to grow plants with the raw untreated water. Sample further was passed on for the testing purpose. The sample of greywater has been collected in the view of strength of greywater, which is mostly affected by duration of time like in the morning it is supposed to be high strength, at noon it might be average and at night it might be low concentration. So according to the above case we have collected two samples having high strength and average strength, named as sample 1 and sample 2. The results of nutrients in both samples have been tabulated below.

IX -CONCLUSION

After studying the hydroponic husbandry system, we came to know that setup is one time cost but the regular recreating cost for this system is Nutrient water, which is generally expensive. As we know from the study that waste water(Greywater) is rich in nutrients. So then we're trying to study the feasibility of Greywater with minimum treatment as an alternative for nutrient water.

X- FUTURE SCOPE

The further study of the same process is continued at present to get proper idealization about the cultivation of crops by using treated Greywater and also nutrients contents of vegetation produced by the same. The same study is being continued to evaluate the nutrients of vegetation cultivated from hydroponic farming using greywater as nutrient water. Rate of Growth will also be compared with respect to soil based systems. Color of leafy crops will also be visualized by naked eyes. The product from Hydroponic greywater farming will also be checked against safety of consumption.

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