Aquaponic Farming Using Treated Water

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Abstract **- This research paper's primary goal is to highlight the distinctions between secondary treated sewage waste water and regular RO water for hydroponic and aquaponic plant production. Traditionally, RO water has been used for aqua and hydroponic plant culture. However, we have utilized secondary processed sewage waste water for ponic plant cultivation, defying convention. When we refer to secondary treated sewage waste water, we mean that this waste water has been purified to a secondary stage at a sewage treatment plant. The procedures involved in this process which include decanting, aeration, grit removal, settling, segregation, bacteria growth for purification, and chlorination will be covered later in the paper, though we chose not to use chlorination in the water.**

I. INTRODUCTION

Aquaponics is a food production system that combines hydroponics—the water-based plant cultivation method—with aquaculture—the tank-based rearing of aquatic creatures like fish, crayfish, snails, or prawns—by feeding the nutrient-rich aquaculture water to the hydroponically grown plants. Since all aquaponic systems are based on current hydroponic and aquaculture farming methods, the size, complexity, and kinds of food produced in an aquaponic system might differ greatly from any system found in each specific agricultural discipline. The bacteria in an aquaponics system create a biofilm on all solid surfaces that are in regular contact with the water. This process converts ammonia to nitrates that plants can use. Together, the veggies' submerged roots provide a big surface area on which a lot of germs can grow. The surface area controls how quickly nitrification occurs, along with the water's ammonia and nitrite concentrations. Maintaining these bacterial colonies is crucial for controlling the complete absorption of nitrite and ammonia. For this reason, a biofiltering unit is a common component in aquaponics systems, aiding in the proliferation of these microbes. Ammonia levels typically range from 0.25 to.50 ppm when a system has stabilized; nitrite level

II. BENEFITS AND DRAWBACKS

Advantages

- Since it doesn't need soil, it is immune to illnesses spread by the soil.
- Chemical fertilizers and insecticides are not necessary.
- The main advantages of aquaponics are higher yields and better quality.
- Aquaponics lowers the chance of external contamination and increases biosecurity.
- Why Because aquaponics is simpler to maintain than soil, it provides greater control over the production process and reduces losses.
- Because aquaponics mimics nature's cycle process, it produces less waste and can be used in non-arable areas like deserts, deteriorated soil, and salty, sandy islands.

III. LITRETURE REVIEW

Six popular commercial water purifier brands were compared and evaluated in this experimental investigation. Specimens were taken immediately prior to, during, and six months following device setup. The fluoride removal of each household water cleaner was then compared using spectrophotometry (the Harrison device). Six popular commercial brands of water purifiers in Ahwaz were compared in this study. The following commercial brands were assessed in the current study: water safe (granular carbon cartridges filters; lcv (lead, cysts, voc's) (carbon block filter cartridges, China), alkusar (special media cartridges filters; prb50-in, USA), puricom (special media cartridges filters; watts 4.5" x 10" dual housing, Korea), and cck (ceramic and ceramic/carbon cartridges; rtx-ts dlm filters, Korea), soft water (ceramic candles; alpine tj series filters, w9332420, USA). The goal of this study was to create a low-cost, user-friendly portable antibacterial water filter.

Characteristic	Concentration Required
pH value	6.5-8.5
Dissolved oxygen	8-10 ppm
Ammonia @5°C	0.0-0.1 ppm
Chloride	6570 mg/l
Chlorine	4-5 mg/l
Hardness	4-12 ppm
Turbidity	5 NTU

Methods: After the water filter was designed, a prototype was built. To perform water analysis, layers of cotton, fabric, activated charcoal, and sand were constructed with compartments.

Findings: The Vellore Institute of Technology, lake water's most likely number index was compared to that of filtered water. After a thorough investigation of the water, it was found that the sand filter layer was primarily responsible for the filter's antibacterial activity.

In conclusion, the study showed that the suggested water filter design effectively reduces the water's acidity while also eliminating turbidity, odor, and microbiological content from lake water.

IV. METHODOLOGY

1. Planning and Design of the Project: • Establish the goals and parameters of aquaponic farming.
• A thorough investigation into laundry waste water and the methods used to treat it.
2. Gathering waste water from homes:
• Water should be gathered from clothes washers and washing machines.
• Needs to be kept in a container.
3. Examination of the collected water's characteristics:
• A thorough investigation of the water's pH value and chemical composition is required.
4. Waste water treatment: Measures such as ammonia dumps, coagulation and flocculation, etc., must be taken to ensure that the chemical composition of the water is suitable for the survival of aquatic life.
5. Building the aquaponic layout: • Tank, biofilters, and sump bed are necessary for an aquaponic system.
• The connection that needs to be created begins at the treated water storage container, travels via the biofilter to the aquarium, and ends at the sump bed.
6. Proper maintenance of the sump bed: Regular inspections of the bed are required, and any extra water should be drained from the drain hole to prevent water overcrowding and stunted crop growth.7.Soil quality testing: • It is necessary to test the soil to determine which crop or plants will develop best, as well as to get a thorough understanding of the nutrients available in the soil and whether they match crop growth requirements.
8. Comparing the tested soil with soils that have chemical fertilizer (Soil 1) and soils that have fertilizer based on cow dung (Soil 2).Thus, the comparison helps determine whether soil is more affordable and has excellent nutritional properties.

TESTS

pH testing (part II of IS 3025)

Required Equipment: pH test kit, water sample

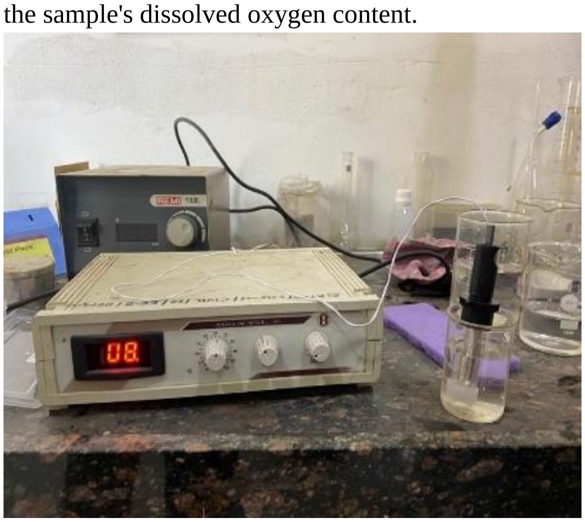
Steps to follow: 1. Gather a greywater sample in a sterile container.
2. Dip a pH indicator strip into the greywater sample and let it stay there for a little while.
3. Take off the strip and match its color to the color chart that comes with the test kit. This will show the greywater sample's pH.
4. If using a pH meter, calibrate it in accordance with the guidelines provided by the manufacturer.
5. Take a pH reading by dipping the pH meter probe into the greywater sample.
6. Take note of the pH reading.
7. Greywater normally has a pH between 6.5 to 8.5, which is slightly acidic to slightly alkaline.

Dissolved oxygen test (IS 3025)

The following equipment is needed: sulfuric acid, manganese sulphate, BOD bottles, sample water, and an alkali iodide-azide reagent.

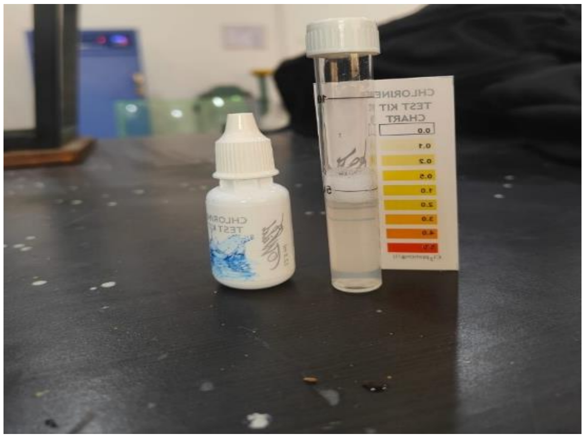
Method: 1. Gathered a sample of water and put it in a sterile glass flask or bottle. To reduce the amount of dissolved oxygen lost while handling, the bottle should be completely, filled.

2. Fill the sample with one milliliter of alkali iodide azide. Iodine will be created as a result of the dissolved oxygen reacting with the iodide ions.
3. Fill the sample with 1 milliliter of manganese sulfate. This will facilitate the reaction between the sodium hydroxide and iodine.
4. Close the bottle or flask right away, then give it a good shake to make sure the reagents are well mixed.
5. Permit the precipitate to accumulate. When the precipitate turns brown, it means that oxygen is present in the sample; when it turns white, it means that oxygen is lacking.
6. To allow the reaction to finish, let the sample stand for five to ten minutes.
7. In order to dissolve the precipitation, add 1 milliliter of sulfuric acid to the sample.
8. Add sodium thiosulfate to the sample and titrate it until it turns straw yellow or pale yellow.
9. Fill the sample with a few drops of starch indicator. The solution will turn blue as a result.
10. Add sodium thiosulfate to the sample and titrate it until the blue hue fades. This shows that the sodium thiosulfate and iodine have completely reacted.
11. Note the amount of sodium thiosulfate that was utilized during the titration. This is a measurement of the sample's dissolved oxygen content.



Comprehensive solid test (IS 3025)
Step 1: Take a sample temperature reading and record it.
2. Use a balance to weigh and record the weight of a dry, clean evaporating dish.
3. To get rid of any suspended particulates, pass the water sample through filter paper that has been previously weighed.
4. Next, put the filtered sample on a hot plate or Bunsen burner after transferring it to the evaporating dish.
5. Use a low heat source to evaporate the sample's water until all of the water is gone and just a dry residue is left in the dish.
6. Weigh the evaporating dish with the dry residue and note the weight after letting it cool in a desiccator for ten to fifteen minutes.

Test for chlorine
Equipment Needed: Water sample, chlorine test kit
Step 1: Transfer 50ml of water into a test jar.
To this water, add 5ml of the "chlorotex" reagent.
3. Carefully stir everything together, let it rest for a minute, then check the color to make sure it matches the color chart on the reagent container.
4. There is no chlorine present if the color is white with milky fluorescence.
5. A pale pink color indicates a chlorine concentration of 0.1 parts per million.
6. The chlorine content is 0.2 parts per million if the color is medium pink.
7. A dark pink color indicates a 0.5 parts per million concentration of chlorine.
8. A bright blue hue indicates 0.6 parts per million of chlorine.
9. The concentration of chlorine is when the color is medium blue.



Test of Cholride (IS 3025)

Burrete, an Erlenmeyer flask, a pipetter, a measuring cylinder, distilled water, silver nitrate solution, potassium chromate indicator, and a natural indicator are the necessary pieces of equipment.

Method: 1. Dilute 50 mL of sample (V) to 100 mL.

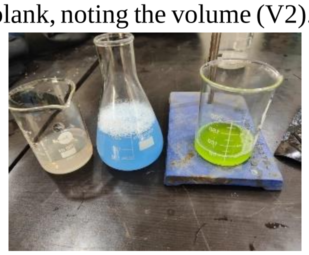
2. Add 3 mL of aluminum hydroxide if the sample is colored, shake well, let it settle, filter, wash, and gather the filtrate.

3. The sample is adjusted to a pH of 7–8 by adding alkali or acid as needed.

4. Add one milliliter of potassium chromate indicator.

5. Titrate the mixture until it turns reddish brown by comparing it to a standard silver nitrate solution. One obtains precipitate. Write the volume (V1) down.

6. Proceed as before for blank, noting the volume (V2).



V. CONCLUSION

Growing fish and vegetables together using a sustainable combination of hydroponics and aquaculture is known as aquaponics farming. Fish waste is transformed by nitrifying bacteria, which then provide organic nutrients to plants. Fish are helped to survive by the plant roots, which filter the water. You may grow sustainable food with aquaponics indoor farming, which requires less labor and water inputs. Therefore, in order to increase food yield, urban producers would be wise to consider an aquaponics farm. In comparison to other similar products, ferric chloride by the FeCL3 formula is one of the few effective compounds in the water and wastewater treatment industry that speeds up the sedimentation process. Its characteristics and analysis also show that ferric chloride is quite effective at eliminating the taste and odor of water. Ferric chloride also has the benefit of having no side effects or limitations. It is well known that aluminum sulfate works well in treating Alzheimer's disease. The Bio-filter was utilized for all necessary layering, and the layering was adjusted based on the amount of water sample and the water's flow rate. The results of numerous tests, including those measuring pH, chloride content, chlorine content, water hardness, dissolved oxygen, total solids, and so on, confirmed that the water's quality could be easily controlled in terms of pH, chloride content, and chlorine content with the use of ferric chloride ($FeCl_3$) and bio-filters for pre- and post-treatment filtering. Coagulation and flocculation were used to treat the oil and grease that was in the water.

Because the water was soapy, its hardness presented treatment issues. Sodium compounds, such as sodium chloride and resins, were used in combination with sodium powder to treat the water. Although the hardness level was lowered, the final product did not meet the standards needed for aquaponic farming and vegetative growth. The hardness result was not up to par; the permissible range for hardness is between 4-6 mg/l, and the final result was higher than 10 mg/l. Since it may be detrimental for freshwater fish to thrive in this environment, the test in question can be deemed hazardous for fish farming and ineffective.

VI. REFERENCE

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