Imposition of Aquaponic & Hydroponic system on Rotating Biological Contactor to water reclamation in Hubballi - Dharwad

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***Abstract*: Dissolved and particulate organic matter, total dissolved solids, nutrients such as phosphorus and nitrogen are the main component in aquaculture wastewater that can create environmental issues as well as negative impacts on fish growth. Due to rapid urbanization and industrialization not only the cultivable land is decreasing but also conventional agricultural practices causing a wide range of negative impacts on the environment. To sustainably feed the world's growing population, methods for growing sufficient food have to evolve. Hydroponics and Aquaponics techniques has gaining popularity because of its efficient management of resources and food production. During the study period we have obtained maximum BOD removal efficiency 78.94% at 30 day. During study period we have obtained maximum TDS is 183ppm at 30 day, Turbidity is 7.4 NTU 30 day & DO is 6.3 mg/l 30 day. During study period we have observed maximum growth of plants approximately for tomato is 19.2cm (94%), Red spinach is 15.2 (93%), and Pink Moss-rose 21.2 (86%).**

***Index Terms*: Aquaponic, Hydroponic, Rotating Biological Contactor, Water Reclamation**

1.INTRODUCTION:

Due to rapid urbanization and industrialization not only the cultivable land is decreasing but also conventional agricultural practices causing a wide range of negative impacts on the environment. To sustainably feed the world's growing population, methods for growing sufficient food have to evolve. Hydroponics and Aquaponics techniques has gaining popularity because of its efficient management of resources and food production. Aquaponics is the fusion of aquaculture, the process of raising fish, with hydroponics, the practice of raising plants without soil. The fish tank is connected to the plant bed, and friendly bacteria convert the fish waste in the water into available nutrients for the plants, creating a symbiotic relationship. Aquaponics systems can provide a number of benefits over traditional in-soil gardening. It has been demonstrated that in some plants, including leafy greens such as lettuce, that increased nutrient availability can greatly speed the growth of plants. Furthermore, due to the recycling of water within the system, waste is minimized and overall water consumption is drastically reduced. Weeding is also non-existent in aquaponic systems, as there is no soil. The science of soil-less gardening is called hydroponics. It basically involves growing healthy plants without the use of a traditional soil medium by using a nutrient like a mineral rich water solution instead. A plant just needs select nutrients, some water, and sunlight to grow. Not only do plants grow without soil, they often grow a lot better with their roots in water instead. Hydroponic gardening is fast becoming a popular choice for many growers around the world due to its more sustainable approach to resource usage than the usual growing methods. A rotating biological contactor or RBC is a biological fixed-film treatment process used in the secondary treatment of wastewater following primary treatment. The primary treatment process involves removal of grit, sand and coarse suspended material through a screening process, followed by settling of suspended solids. The RBC process allows the wastewater to come in contact with a biological film in order to remove pollutants in the wastewater before discharge of the treated wastewater to the environment, usually a body of water (river, lake or ocean). A rotating biological contactor is a type of secondary (biological) treatment process. It consists of a series of closely spaced, parallel discs mounted on a rotating shaft which is supported just above the surface of the wastewater. Microorganisms grow on the surface of the discs where biological degradation of the wastewater pollutants takes place. Rotating biological contactors (RBCs) are capable of withstanding surges in organic load. To be successful, micro-organisms need both oxygen to live and food to grow. Oxygen is obtained from the atmosphere as the disks rotate. As the micro-organisms grow, they build up on the media until they are sloughed off due to shear forces provided by the rotating discs in the sewage. Effluent from the RBC is then passed through a clarifier where the sloughed biological solids in suspension settle as sludge.

The primary objective of this study is to

1. To study physicochemical and biological characteristic of waste water.
2. To fabricate aquaponic and hydroponic system coupled with Rotating biological contactors.
3. To find out BOD and COD removal efficiency.
4. To integrate optimized components into an existing design of RBC
5. To evaluate potential agricultural productivity, waste water treatment efficiency with respect to cost.

2.MATERIALS AND METHODOLOGY:

Materials Used:

1. Plastic water tub: Used as waste water storage tank, in which the collected waste water is stored for the further usage
2. PVC pipes: Used as a media for inlet and outlet of the water
3. Rubber pipes:Act as sampling ports

4. Wire mesh: Act as a separating media.
5. Sealants: It is a substance used to block the passage of fluids through the surface or joints or openings in materials, which intend acts as binding material
6. Hollow PVC shaft
7. Emitter: Used To control the movement of the shaft
8. Influent tanks: Influent is water that "flows in". This is the raw, untreated wastewater. This water is collected in an Influent tank.
9.Effluent tanks: Effluent means to "flow out". This is the treated wastewater. The treated waste water is collected in effluent tanks.

Methodology:

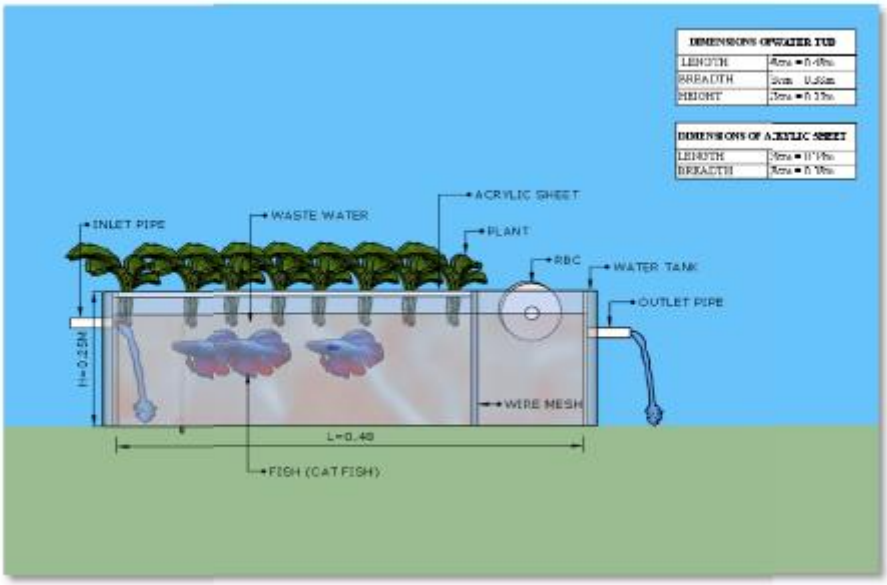
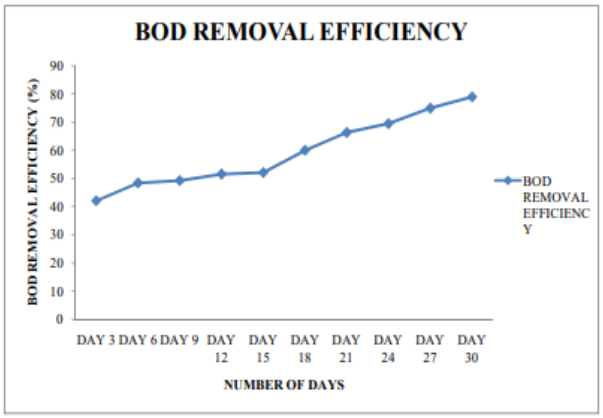


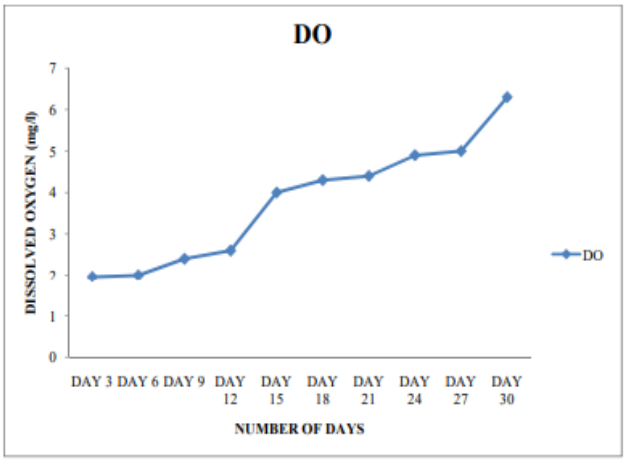
Fig: Project Set up

PROCEDURE:
1. Collection of domestic waste water and selected ind Dharwad district
2. Fabrication of Aquaponic and Hydroponic system with rotating biological contactor
3. Waste water from Hubballi-Dharawad is filled in fabricated reactor.
4. After some days plants will start utilizing start utilizing waste water as a food source
5. During this study period BOD and COD level will be monitored
6. During this study period important controlling parameters like Ph, Turbidity, solids, acidity, alkalinity, DO, nitrates, ammonia, conductivity will be analysed by observing behaviour of the Rotating biological contactor

3.RESULTS AND DISCUSSION:

3.1.BOD Removal Efficiency and DO level during study period :





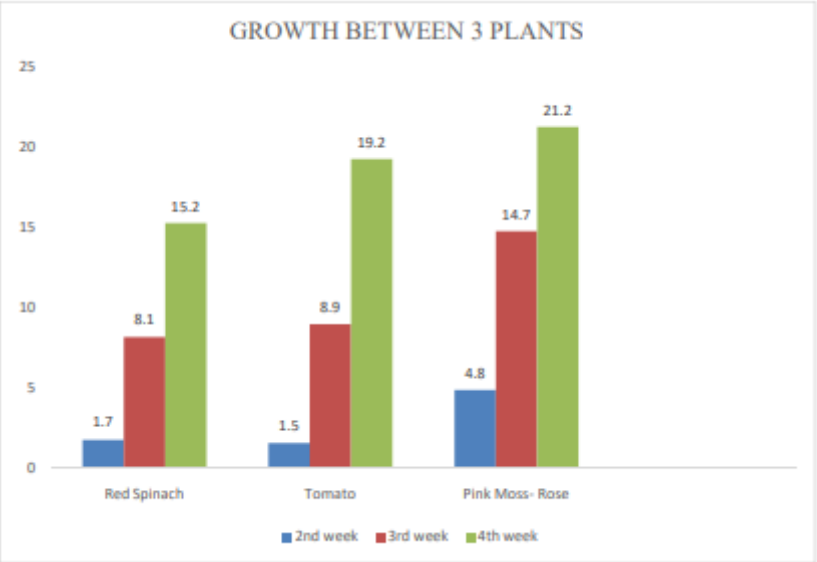
BOD REMOVAL EFFICIENCY%

DAY 3	550 mg/l	42.10%
DAY 6	490mg/l	48.42%
DAY 9	482mg/l	49.26%
DAY 12	460mg/l	51.57%
DAY 15	455mg/l	52.10%
DAY 18	380mg/l	60%
DAY 21	320mg/l	66.31%
DAY 24	290mg/l	69.47%
DAY 27	238mg/l	74.94%
DAY 30	200mg/l	78.94%

DO	
DAY 3	1.96 mg/l
DAY 6	2 mg/l
DAY 9	2.4 mg/l
DAY 12	2.6 mg/l
DAY 15	4 mg/l
DAY 18	4.3 mg/l
DAY 21	4.4 mg/l
DAY 24	4.9 mg/l
DAY 27	5 mg/l
DAY 30	6.3 mg/l

As we can observe the BOD removal from the domestic waste water. As water is aerated with the help of rotating biological contractor it increases the do level in the water i.e decline in do levels reflects a high level of BOD. As we can observe the DO increase level in the domestic waste water. As water is aerated with the help of rotating biological contractor it increases the DO level in the water. The range of DO in drinking water should be 6.5-8 mg/l. About 4mg/l of minimum DO should be maintained in water for fish survival. Sucker fish can survive in lowest DO also.

2.Plant behavior/Growth during study Period:



The above mentioned graph shows the result of 30 days observation of the Tomato plant. At the first week, as there was no growth in the plant, but at the 25th day we have observed a drastic increase in the growth of the plant which is due to the NPK content present in the water and the ammonia excreted by the fish. The above mentioned graph shows the result of 30 days observation of the Red Spinach plant. At the first week, as there was very little growth in the plant, but gradually the growth started increasing in the upcoming weeks. In the case of Red Spinach plant equal amount of growth was observed in every 5 days after the first week of observation. The above mentioned graph shows the result of 30 days observation of the Pink Mossrose. We have observed the growth by the end of the 1st week of plantation, also observed the gradual increase in the growth of the plant within the 30 days. By the 20th day we have observed drastic increase in the growth of the plant, also within 30 days we have observed blooming of flowers and

growth of baby plants. Red Spinach, Tomato and Pink Moss-rose, within the span of 30days the growth observed in Pink moss-rose is more as compared with the other two plants.

4. CONCLUSIONS:

Based on the laboratory experiments we have concluded that,Maximum BOD removal efficiency is 78.94% at 30 day. Maximum TDS is 183 ppm at 30 day. Maximum Turbidity is 7.4 NTU at 30 day and Maximum DO is 6.3 mg/l at 30 day. During study period we have also observed maximum growth of plants approximately for Tomato is 19.2cm (94% growth), Red spinach is 15.2 cm (93% growth), and Pink Moss-rose 21.2 cm (86% growth).

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