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RAISING OF COMPREHENSIVE GREEN BUILDING VIA VERTICAL FARMING WITH THE HELP OF SOLID WASTE MANAGEMENT AND GREY WATER TREATMENT

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Abstract: Sustainable or "green" building is the concept of using resources more efficiently while creating more energy-efficient and sustainable homes, offices, schools and other buildings. Out of many approaches for making the building green, few are studied in depth. I.e. Vertical farming, solid waste management, grey water treatment, automated irrigation system. Vertical farming is a new technique in farming, in which we can grow crops without actual usage of land. (I.e. in building area itself) instead of wasting of time and money, for transporting food from farms in to cities, which is also called as step-by-step farming. To satisfy human needs some portion of height of building may be utilized. Considering future problems regarding to scarcity of land, water shortage, global warming, ozone-depletion, waste generation, pollution, diseases etc., feasible way to overcome these issues is urbanized farming, which can give proper yield, by utilization of waste using methods like decomposing and composting, treatment on grey water, etc. This helps in reducing dependability on municipal waste supply, provides quality environment, and to generate food for household purpose in energy efficient and sustainable manner from quantitative and qualitative approach. Solid waste management is one among the basic essential service provided by municipal authorities within the country to stay urban centers clean. However, it is among the most poorly reduced services in the basket. The systems applied are unscientific, outdated and inefficient; population coverage is low and incapable of dealing ever- growing problem of solid waste management. So study of this project determines how the problem can be overcome by household solid waste management. It can be done with various types of composting. The solid waste manure generated from the process can be used in household vertical farming. For greywater management, ponds are most suitable. The stabilization tank manufactured from low cost material is very cost-effective. Low-cost material can be used to line the ponds and convert the flow of ponds into the form of modified stabilization tank which is very effective. This study analyses this method for treatment of household grey water. These attributes with appropriate technologies may prove to positive contribution in smart city development with the help of integrated approach towards comprehensive green technology. i.e. what is expected.

Index Terms **- Green building, Vertical farming, Solid waste management, Grey water treatment.**

I. INTRODUCTION

Today we are a population of billions. Planet earth has many resources some are renewable some are non-renewable. As humans evolved, they brought industrial revolution. As time went by, human needs began to increase, with the increase in needs we started to deplete mother earth of its resources. Our activities have caused many problems such as global warming, deforestation, increase in pollution etc. These problems cause imbalance to the natural cycle of environment. Their effects can be seen today itself, think what will happen in the future we continue with our actions?

Revolution is necessary, but we can do certain things which will reduce its harmful impact on our environment. Globally, homes are answerable for a big share of electricity, power and water and substances intake. The building region has the finest ability to deliver substantial cuts in emissions at very little value. Homes account for 18% of world emissions these days or the equal of 9 billion heaps of CO2 yearly. Solution for this problem is green building technology. Green building refers to structure and the application of tactics which are environmentally responsible and resource-efficient at some stage in a building's existence-cycle: from planning to design, construction, operation, renovation, maintenance and demolition. Goal of green building technology is to use sustainable materials and to design structure in such a way that it will have maximum benefits of natural resources such as sunlight, free flowing air etc. This will reduce the use of electricity and also use of mechanical devices such as fans, air conditions etc. Thus, reducing their harmful impact on environment. There are additional things which will make the building green building. This paper focuses on below point which will help to reduce strain on environment.

❖ Solid waste management

Solid waste is that the unwanted or useless solid materials generated from human activities in residential, industrial areas. Human activities create waste. Wastes are the collected, stored, processed and disposed off which pose danger to surroundings. Urbanization and improvement in living standards has led to increase in amount and complexity of generated solid waste. Mounds of garbage are a not unusual sight nowadays. Waste thrown is omnipresent within the form of rotting piles that dot our panorama, foul our rivers and pollute our wells and lakes. Even the idea of a quaint, clean village is now not proper because trash has triumph over the rural-urban divide very efficaciously. Solid waste management is a term this is used to refer to the manner of accumulating and treating solid wastes. It also gives answers for recycling objects that do not belong to garbage or trash. As long as human beings had been residing in settlements and residential regions, rubbish or solid waste management has been a difficulty. Waste control is all about how strong waste may be changed and used as a valuable useful resource. strong Waste management reduces or gets rid of the unfavorable effect on the surroundings & human health. A number of tactics are concerned in efficaciously handling waste for a municipality. these include monitoring, collection, transport, processing, recycling and disposal. The quantum of waste generated varies specifically because of different existence, that is at once proportional to socio economic repute of the urban populace.

❖ Vertical farming

Vertical farming is that the urban farming of fruits, vegetables, and grains, within a building in an exceedingly town or metropolis, during which floors are designed to accommodate sure crops using hydroponics. Whereas the construct of provision food in cities isn't a brand new one, the thought of dedicating a complete building or building to cultivate products. The construct of vertical farming may be a large-scale extension of urban agriculture inside a building.

Needs of Vertical Farming: These are the following needs to vertical farming and its technologies given as follows,

- Preparation for the future
- Increased crop production
- Protection from weather-related problems
- Conservation of resources
- Organic crops
- Halting mass extinction

Impact of vertical farming:

- Reduction of energy costs in transportation.
- Year-round crop production preparation protection from weather.
- Crops are then sold within the same infrastructure (reduction of crop waste).
- Elimination of crop machinery fossil fuel emissions.
- Growth of enough food to replace lost productivity as farmland is urbanized.

❖ Grey water treatment

Greywater is the water which has been used for household purposes like washing dishes, laundering garments etc. essentially, any water, apart from lavatory wastes, draining from a household is grey water.

Waste water management is a enormous detail of sanitation activities. unless liquid waste is managed properly, it turns into a sizable health risk in rural areas. It is envisioned and experienced that approximately 75% to 80% of water supplied through piped water deliver schemes comes out as grey water. If it is not controlled well, it flows haphazardly through habitations and turns into a extreme health hazard because of its pathogenicity. Similarly, it provides a propagation ground for sickness spreading insect vectors like mosquitoes and so on. Therefore, it ought to be controlled in a hygienic manner. In a country like India, where water availability is a problem, it have to be likely recycled and reused. The treatment technique ought to purpose on making such water pathogen free and it must no longer promote insect breeding, and at the same time, this water will be recycled and reused.

There are many treatment options, but this paper focuses on the idea presented in the paper Grey Water Management by using Stabilization ponds. The idea presented by them is a low cost technique for construction of stabilization pond for rural area. This paper applies the same concept to urban area. Urban area may not face water scarcity yet but in future lack of water is going to be huge problem. It is todays need to save water. This project suggests that each residential buildings must install a stabilization pond technique to treat grey water and use the treated water for gardening, washing cars, vertical farming etc

Above are the aspects covered in this paper. Combination of these three aspects will help to reduce pollution impact on environment thus making an existing building green building.

II. MATERIAL AND METHOD

❖ **Solid waste management**

The method used for solid waste management is the Bokashi composting method. It is an anaerobic process that is predicated on inoculated bran to ferment kitchen waste, inclusive of meat and dairy, right into a safe soil builder and nutrient-wealthy tea to your plant life. Bokashi is perhaps one in every of the least expensive composting systems around. Two buckets of 30cm diameter and height 32cm are required. One of the bucket must have an air tight lid. A faucet is also required to draw out the liquid. A bag of bokashi bran is also needed.

Fig. 1 Two Buckets One with faucet and another with holes at base are arranged

.

Fig. 2 Putting garbage in layer and tamping and sprinkling bokashi powder

Bokashi powder in the amount of 10 grams was sprinkled in the bottom of the bin. Food waste was cut into pieces and put in the bin about 3-4 cm. Bokashi powder in the amount of 60 grams was sprinkled again over the food waste. The air was removed from the bin by pressing down the food waste. The lid was ensured to be closed-tight and let it sit for 10 to 14 days. The Bokashi liquid was drained 3 times a week to avoid the mixture too moist. The fermented food waste was transferred 1/3 into a pot that filled with soil and let it sit again for 2 weeks. The product became when it pressed by hand, it formed a ball and it crumbled when disturbed. The product was covered with a plastic bag for further analysis. This compost is used as fertilizer for plants.

- **Vertical Farming**

Materials used: Coco pit, Wooden-dust, Dry leaves, Cow dung, Fertilizer, Dry organic waste.
Crops Sown: Tomato, Chilly, Spinach, Coriander, Basil, Fenugreek.
A vertical trench tank of dimensions 1.1*09*0.4m is taken. Holes were made for seeping out water at regular intervals. Coco peat was kept in the trench, followed by layer of wooden dust and dry leaves. Soil is added followed by dry organic waste and the fertilizer which is made from kitchen waste. Seeds are added and watered according to its need and after its cultivation period yield will get generated.

Fig. 3.Laying Coco Pit and Dry Leaves

- **Grey Water Treatment**

The grey water is sampled from staff quarters, of the building. The samples from site are collected for period of four months. The laboratory scale model is split in three parts i.e. inlet or feeding tank, modified stabilization pond system and outlet assembly tank. The model has inlet provision in plastic tub with 30 lit capacity and it is marked with scale for 1,3,5,7 up to 30 lit. Inlet is provided through the pipe with the control valve for adjustment of flow. Similar tub is provided for the outlet collection. The size and shape of all the tubs are same. The length of tub was kept more than the depth, so as to get proper contact time to wastewater. The modified stabilization pond is made up of tubs having 55 cm length, 23.5 cm width and 24.5 cm height (depth). It is divided in five compartments and each compartment is covered with lining material i.e. tarpaulin sheet. Two end caps are provided to each compartment. For these end caps, we have given the alternate bottom and upward side openings with 1 inch from bottom and the level of 25 liter at top. Two compartment of reactor are connected using 10 cm length pipe having diameter 2.5 cm. the length of each interconnecting pipe is kept small, so as it provide stability to tanks. Sufficient free board is provided to each cret. It is necessary to check for any leakage in tanks. Pisciculture is carried out in 3rd, 4th and 5th compartment. These three compartments' inlets and

outlets are closed with plastic wire mesh to avoid migration of fish and chances of blockage due to fish.. The system is covered with garden net to control sun penetration. The entire system is open to atmosphere.

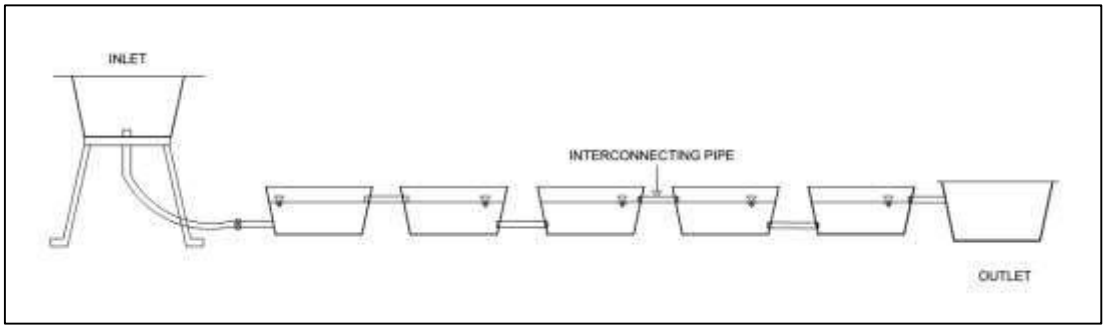

Fig. 4. Experimental setup of modified stabilization ponds

III. RESULTS AND DISCUSSION

The grey water was sampled and studied for 5 months, the results obtained are positive.

❖ pH variations

Fig 5 shows pH variation of grey water samples with respect to cycles. The pH of inlet and outlet was within the range of 7.2 to7.5 and 7.3 to 9.0 respectively. The pH is observed to vary up to 9.0 because of sunlight penetration and photosynthesis.

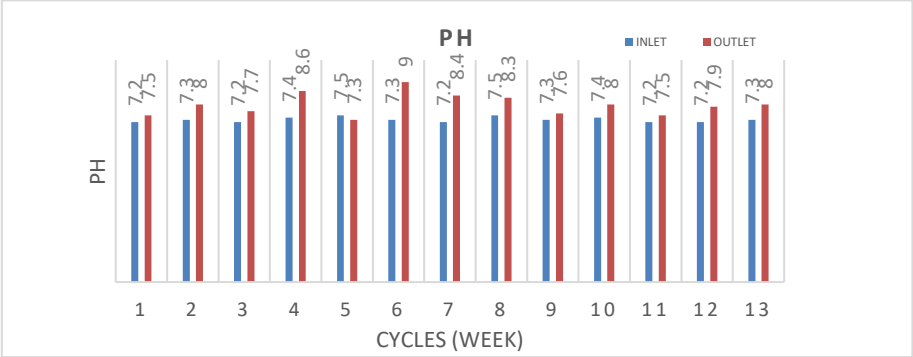

Fig.5. pH variation with cycles

❖ COD variation of samples

Fig 6. shows the variation of COD value of grey water samples with respect to cycles. It shows the overall performance of model. The inlet COD was found to vary in the range of 220 to 300 mg/l and outlet COD varied from 32 to 178 mg/l.

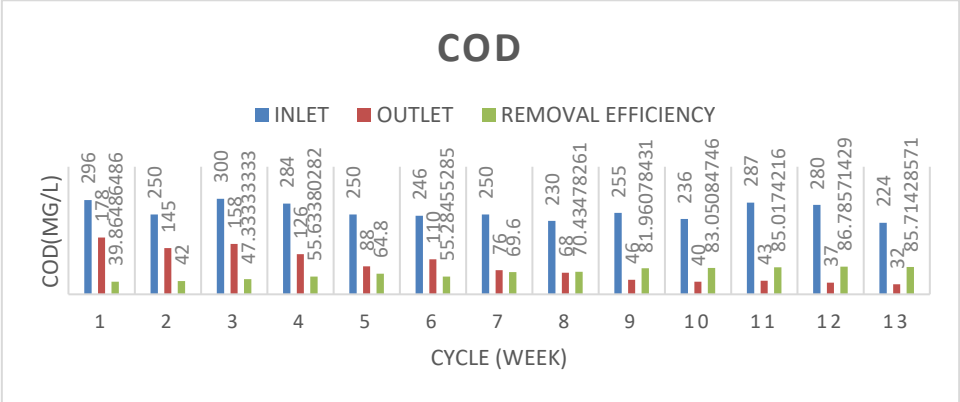

Fig. 6. Inlet and outlet COD of grey water and reduction percentage

❖ BOD variation of samples

Fig. 7. shows the variation of BOD value of grey water samples with respect to cycles. It shows the overall organic load on the model. The inlet BOD varied in the range of 132 to 220 mg/l and outlet BOD varied from 20 to 63 mg/l.

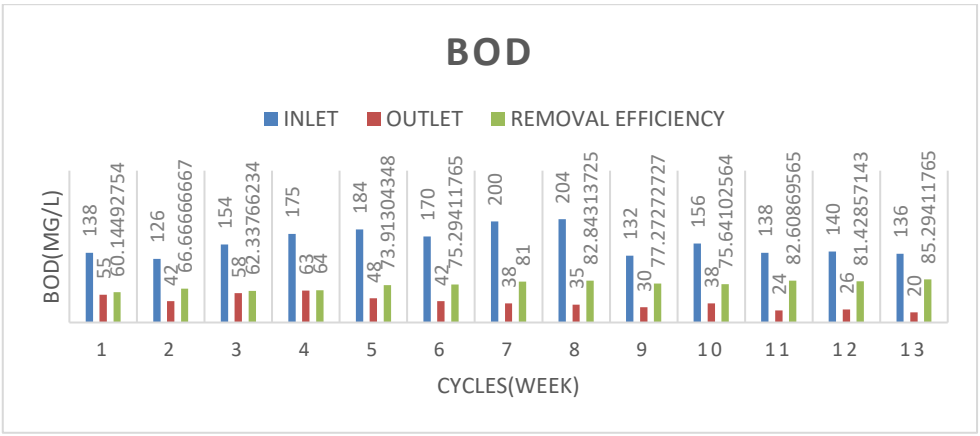

Fig.7 Inlet and outlet BOD of grey water and removal efficiency percentage

❖ TS variation

Fig 8 shows the TS variation with respect to cycles. The inlet TS are found to vary in the range of 980 to 1560 mg/L and outlet TS varied from 380 to 520 mg/L.

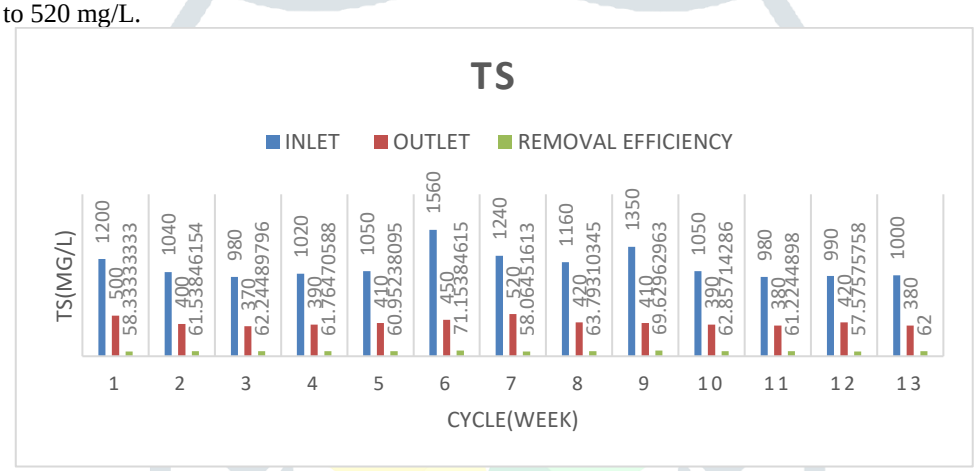

Fig. 8 Inlet and outlet TS of grey water and removal efficiency percentage

❖ TDS variation

Fig 9. shows the TDS variation with respect to cycles. TDS is nothing but dissolve form of organic and inorganic matter. The inlet TDS are found to vary in the range of 430 to 500 mg/L and outlet TDS varied from 320 to 410 mg/L.

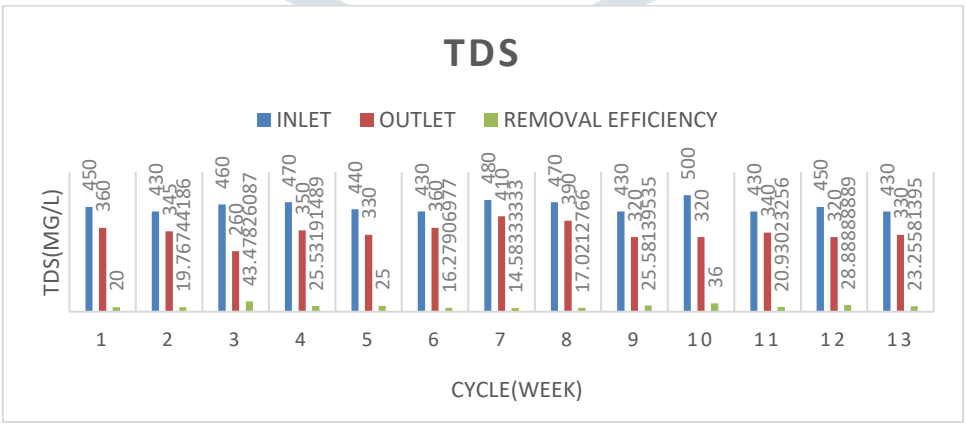

Fig. 9 Inlet and outlet TDS with removal efficiency

❖ TSS variation

Fig 10. shows the TSS variation with respect to cycles. TSS is nothing but suspended form of organic and inorganic matter. The inlet TSS are found to vary in the range of 460 to 1050 mg/L and outlet TSS varied from 45 to 110 mg/L.

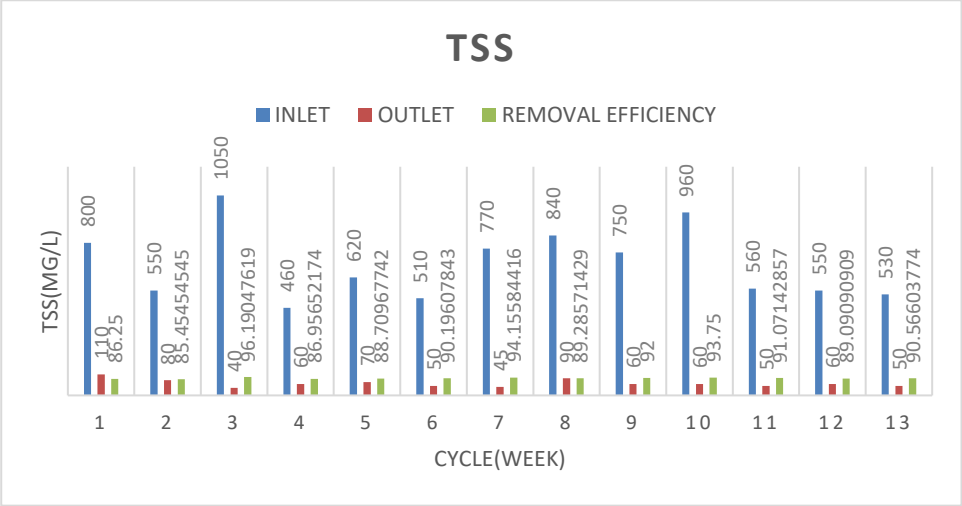

Fig. 10 Inlet and outlet TSS with removal efficiency

IV. CONCLUSION

Vertical farming generated sufficient yield for family reason. This farming turned into very economical with respect to fee gain ratio. This results in conclusion that, with least effort and cash you can still do urban farming for his own motive correctly.

Solid waste turned into decomposed the use of anaerobic digestion. Manure produced by way of decomposition of kitchen waste become nutrient rich. The liquid and strong manure generated became used efficiently as fertilizer in household farming. This results in end that possible deal with the family stable waste with budget friendly anaerobic digestion to generate compost with least efforts.

Approach of Stabilization ponds may be followed for residential homes grey water treatment. it is a value effective approach. It presents water for irrigation purpose with essential nutrients in most low-priced way.

REFERENCES

1. Vertical Farming Skyscraper Sustainability Malek Al-Chalabi (Sustainable Cities and Societies) - 12 June 2015.
2. Vertical Greenery System (VGS) for energy saving in building: A Review Gabriel Perez, Juliacoma, Ingrid Martorell, Lusia F. Cabeza, (Renewable and sustainable energy reviews) – 39 (2014)139-165.
3. Environmental Impacts of Urban Hydroponics in Europe: A Case Study in Lyon Daina Romeo, Eldbjørg Blikra Vea, and Marianne Thomsen.
4. Solid Waste Management Challenges for Cities in Developing Countries Lilliana Abarca Guerrero, Ger Maal, William Hogland, (Water Management 2012) 5 Sept. 2014.
5. A Review on Current Status of Municipal Solid Waste Management in India. Neha Gupta, Krishna Kumar Yadav, Vinit Kumar (Journal of Environmental Science) - 27 January 2015.
6. Anaerobic Digestion of Food Waste – Challenges and Opportunities. Fuqing Xu, Yangyang Li, Xumeng Ge, Liangcheng Yang, Yebo Li
7. Study of water availability and its problem Sandeep Thakur, et al., (2013)
8. Study of Low Cost Technologies R. K. Trivedi, (2007)
9. Study of Grey Water and Stabilization Ponds Prof. Dr. Mohammed Ali I. Al-Hashimi et al., (2013),
10. Greywater characterization of an Indian household and potential treatment for reuse.
11. Domestic water treatment – an Indian perspective.

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