



Vertical Forest in multistory Residential Cum Commercial to Eliminate Pollution by Hydroponic Method

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ABSTRACT

Today air pollution is responsible for many health problems in the urban areas. Many metros cities in the world are suffering from air pollution problems. Due to air pollution problem, not only humans but animals and birds were also suffering from this problem. This paper provides an idea that how we can reduce pollution from the air. The simple way to reduce pollution from the air is to grow more and more plants. But in metro cities, there was not that much place available to grow plants or trees on the land. Therefore we are going to introduce "Vertical Forest by Hydroponic Method". We can grow plants on building balcony by Hydroponic technique. In this, we can grow the plant without the help of soil. If we grow the plant by Aquaponics technique than due to that there will be less load on building the structure as compared to using soil.

Key Words: Vertical forest, Hydroponics, Air-pollution, Atmosphere, WHO.

1. INTRODUCTION

Since the first factory was built the atmosphere started to deteriorate. But we all are busy, reports were being publishing, Rivers in Delhi is overflowing with toxic waste. This is the final nail in the coffin. But if we couldn't learn from this yet, than it would be too late to do anything. According to the latest data released by WHO, indoor and outdoor air pollution were responsible for 3.7 million deaths of people aged under 60 in 2012 . Air pollution have reached alarming proportions in most Indian cities, putting people at additional risk of respiratory diseases and other health problems.. Now a day, it's getting difficult to take a fresh breath in the metro cities like Delhi, Mumbai, Chennai etc. So, now the question is what can we do for reducing this carbon from the air. We cannot totally control the air pollution. But we can do something like that which can help to reduce the pollution from air. The only solution to reduce air pollution is to grow more and more plants. But in metro cities there is no that much space left to grow trees or plants. There for now a day's the architecture were designing such a buildings which can absorb more Carbon 1 particles from the atmosphere. The main focuses of the architecture were to grow more plants or trees on the building balconies. So it will create vertical forest in the middle of the cites. Which is very much help full to control air pollution in metro cites. In few countries this new concepts is adopting to take control over air pollution by building a "Vertical Forest" in a mid-city. Which help to reduce CO₂, NO₂ & many other harmful gases from the atmosphere, and produce more oxygen. **By Vertical Forest we can provide fresh air to the citizens of that city in which we build the Vertical Forest..** Vertical forest is the small forest that can be built on a building using less space and making air clean in large amount. Plants can make a building attractive and eco-

friendly. This type of building can be used as commercially or residentially. It also reduces the temperature of building. Our paper is also based on this concept .stefano boeri architecture of Bosco vertical, design an vertical forest in Milan.

In Bosco vertical the plants were grown in soil medium. But due to soil there will be extra load on building structure. To reduce the load from the building we were adopting Hydroponic method to grow the plants on the building.



Fig:1 Bosco Vertical Balcony top view

2. LITERATURE REVIEW

2.1 BOSCO VERTICAL

The Bosco Vertical in Milan, Italy, support one of the most intensive living green facades ever realized. The combination of its sophisticated plant selection, the deployment of greenery in all orientation, the structural design to accommodate the plants, and the maintenance, safety, and the irrigation system, represents one of the most innovative tall building projects in the recent memory. The Bosco Vertical is completed in the year 2014. The Architect of Bosco Vertical is Boeri Studio. The authors of bosco vertical research paper is Elena Giacomello. The Adjunct Professor of Building Technology, Unicersitaluav di venezia, Venice, Italy & Massimo Valagussa&Dr. Massimo valagussa is Director of Laboratory MAC Analysis, Minoprio Foundation Milan, Italy. Elena Giacomello Is an architect with a PhD in building technology.

“Artificial Soil: PhD thesis in building technology”.&Dr. Massimo Valagussa in an agronomist with expertise for arboriculture, horticulture & landscaping. He is a scientific and technical consultant manager of the minoprioanalisi e certification S.R.l Milano an agricultural laboratory for analysis (soil, growing media, irrigation water, leaves and manure). There project consist of two residential tower, The height of tower D is 85 meters consists of 18 stories and Tower E is 117 meters consists of 27 stories. The building gross floor area is 18,717 sq-m, in which surface area covered by green wall is 10,142 sq-m. In Bosco Vertical tower tree planted cantilevering balconies.

The main aim objective of their project is to reproduce the equivalent of 1 hectare of forest vertically, with the attendant benefits of noise and pollution reduction, shading for cooling and aesthetic enhancement, projecting balconies on each floor and on each face are enhanced by trees and bushes placed in concrete planters which act as parapets.

There are about 20,000 specimens and including about 700 trees up to six meter high, installed in a tower. The climate condition of Milan has a humid, subtropical climate that is characterized by hot and humid summers with cold and damp winters. Experiences four seasons and a wide range of temperatures, typically varying from -1°C to 31 C. There is often measurable snowfall from December through February. The remainder of the year consists of rain in spring time and temperatures ranging from 20 C to 30 C during the summer and -1 C to 10 C during the winter.



Fig:2 Bosco Vertical Side View

2.2 HYDROPONIC METHOD

Hydroponics is a subset of hydro culture, the method of growing plants without soil, using mineral nutrient solutions in a water solvent.^[1] Terrestrial plants may be grown with only their roots exposed to the mineral solution, or the roots may be supported by an inert medium, such as perlite or gravel. The nutrients in hydroponics can come from an array of different sources; these can include but are not limited to by product from fish waste, duck manure, or *normal nutrients*.

Continuous-flow solution culture — Nutrient Film Technique (NFT)

In continuous-flow solution culture, the nutrient solution constantly flows past the roots. It is much easier to automate than the static solution culture because sampling and adjustments to the temperature and nutrient concentrations can be made in a large storage tank that has potential to serve thousands of plants. A popular variation is the nutrient film technique or NFT, whereby a very shallow stream of water containing all the dissolved nutrients required for plant growth is recirculated past the bare roots of plants in a watertight thick root mat, which develops in the bottom of the channel and has an upper surface that, although moist, is in the air. Subsequent to this, an abundant supply of oxygen is provided to the roots of the plants. A properly designed NFT system is based on using the right channel slope, the right flow rate, and the right channel length. The main advantage of the NFT system over other forms of hydroponics is that the plant roots are exposed to adequate supplies of water, oxygen, and nutrients. In all other forms of production, there is a conflict between the supply of these requirements, since excessive or deficient amounts of one results in an imbalance of one or both of the others. NFT, because of its design, provides a system where all three requirements for healthy plant growth can be met at the same time, provided that the simple concept of NFT is always remembered and practised. The result of these advantages is that higher yields of high-quality produce are obtained over an extended period of cropping. A downside of NFT is that it has very little buffering against interruptions in the flow (e.g. power outages). But, overall, it is probably one of the more productive techniques.

2.3. TECHNIQUES:-

- Deep water culture

The hydroponic method of plant production by means of suspending the plant roots in a solution of nutrient-rich, oxygenated water. Traditional methods favour the use of plastic buckets and large containers with the plant contained in a net pot suspended from the centre of the lid and the roots suspended in the nutrient solution. The solution is oxygen saturated by an air pump

combined with porous stones. With this method, the plants grow much faster because of the high amount of oxygen that the roots receive.



Fig:3 Rockwool

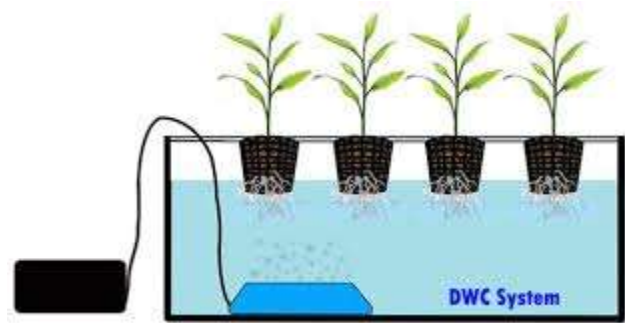


Fig: 4 Deep water culture

3 ROCK WOOL

Rock wool (mineral wool) is the most widely used medium in hydroponics. Rock wool is an inert substrate suitable for both run-to-waste and recirculating systems. Rock wool is made from molten rock, basalt or 'slag' that is spun into bundles of single filament fibres, and bonded into a medium capable of capillary action, and is, in effect, protected from most common microbiological degradation. Rock wool is typically used only for the seedling stage, or with newly cut clones, but can remain with the plant base for its lifetime. Rock wool has many advantages and some disadvantages.

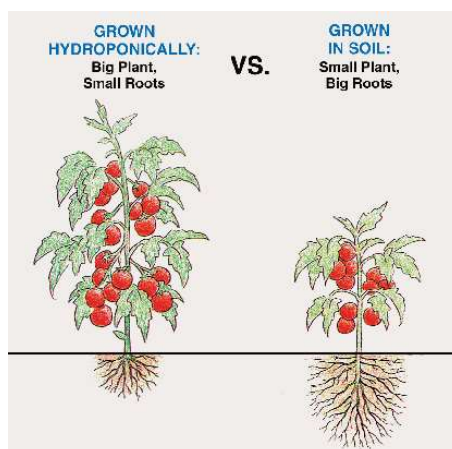


Fig: 5 Soil Roots vs. Rockwool Roots

The latter being the possible skin irritancy (mechanical) whilst handling (1:1000). Flushing with cold water usually brings relief. Advantages include its proven efficiency and effectiveness as a commercial hydroponic substrate. Most of the rock wool sold to date is a non-hazardous, non-carcinogenic material, falling under Note Q of the European Union Classification Packaging and Labelling Regulation.

Mineral wool products can be engineered to hold large quantities of water and air that aid root growth and nutrient uptake in hydroponics; their fibrous nature also provides a good mechanical structure to hold the plant stable. The naturally high pH of mineral wool makes them initially unsuitable to plant growth and requires "conditioning" to produce a wool with an appropriate, stable pH.

OBJECTIVE

- ❖ Our main Aim of for writing this research paper is to reduce air pollution from metro cities. Our idea is to grow plants on the building balconies but without the help of soil medium. Instead of soil we have used Aquaponics method to grow plants in that we use coco peat and Rockwool as a growing medium. In this method we requires less water to grow the plants. Due to this method there will be less load on the building balconies. Because unit weight of water is less as compare of soil. And plants grow much faster than of compare to soil.
- ❖ Due to more plants grown in building due to which they absorb more carbon-di-oxide and release more oxygen. As a result there will be decreasing in air pollution in metro cities.
- ❖ These structures have created a positive impact on urban areas. An urban tree house that protect residents from air and noise pollution. The plants that surround the forest-like apartment helps reduce carbon dioxide. The urban areas are most likely to face air pollution than those living in rural areas because of the "CO₂ domes". These "domes" are invisible carbon dioxide clouds that form over an urban area.
- ❖ The plants from the vertical forests not only reduce carbon dioxide, but it also helps block sounds and traffic noises that come from the streets. As more vertical forest are designed and build in the urban areas, the structures have shown an ethical solution to the urban environments that face serious air pollution by reducing the carbon dioxide in the air. The noise pollution can be blocked by the foliage of the plants and it has help create a microclimate for those urban areas that face the "heat island effect" by cooling the environment with the plant's evaporation transpiration. This makes the urban area more safer and healthy for those living in it.
- ❖ Due to more vertical forest in the cities, the atmosphere on the city get improve. And it will be easy to breath. And by this we can save oxygen for our future generation.

4 METHODOLOGY

- What is Hydroponics ?

Hydroponics, by definition, is a method of growing plants in a water based, nutrient rich solution. Hydroponics does not use soil, instead the root system is supported using an inert medium such as prelate, Rockwool, clay pellets, peat moss, or vermiculite. The basic premise behind hydroponics is to allow the plants roots to come in direct contact with the nutrient solution, while also having access to oxygen, which is essential for proper growth. I highly recommend reading through this guide and learning as much as you can about hydroponics before you start your garden. Even if you don't plan on growing with hydroponics, you can still learn a lot about what plants need in their various stages of growth by reading about the basics of hydroponics.

- Advantages

Growing with hydroponics comes with many advantages, the biggest of which is a greatly increased rate of growth in your plants. With the proper setup, your plants will mature up to 25% faster and produce up to 30% more than the same plants grown in soil. Your plants will grow bigger and faster because they will not have to work as hard to obtain nutrients. Even a small root system will provide the plant exactly what it needs, so the plant will focus more on growing upstairs instead of expanding the roots. All of this is possible through careful control of your nutrient solution and pH levels. A hydroponic system will also use less water than soil based plants because the system is enclosed, which results in less evaporation. Believe it or not, hydroponics is better for the environment because it reduces waste and pollution from soil runoff.



Fig:6 Rockwool as a growing medium



Fig:7 plant in rockwool

4.1 TEST PERFORMED

pH Test

Optimal pH levels are critical to healthy plants and high yields in both soil and hydroponics gardening. Maintaining those optimal levels, especially in soil-less growing systems, calls for frequent, accurate pH testing. Ideal pH levels maximize a plant's nutrient uptake. Those nutrients, in turn, increase a plant's vigor and productivity.

When pH levels are out of a plant's comfort range, its ability to utilize nutrients is reduced or blocked altogether. Out-of-whack pH levels can result in other, critical problems. Nutrient solutions with low, acidic readings cause salts to bind to nutrients in growing mediums, locking them away from plants. High pH solutions and alkaline soils encourage a buildup of these toxic salts

Hydroponic grows are especially responsive to proper pH conditions. But no matter the growing medium, great results come when pH is dialed in to the needs of each plant. How do you know when you're in the pH perfect zone? Here's how to insure your pH testing is as dependably accurate as it can be. pH testing is crucial to agriculture, health care, metal plating, food preparation (including brewing) and a host of other commercial pursuits. Specialized meters, like those made of food-safe materials, meet specific needs. Buying from a reputable gardening supplier who carries pH testing equipment for indoor and outdoor growers guarantees you'll get a meter best suited for gardening.

Most vegetables grown outdoors in soil do well in a range of soil pH levels, generally from slightly acidic (6) to neutral (7). Hydroponics allows growers to pinpoint pH readings to create optimum conditions and maintain them. This not only leads to healthier, more productive plants but also avoids wasting the valuable nutrient solutions you feed them.

When grown hydroponically, most plants require slightly less pH levels than recommended for soil growing. Tomatoes do well in the ground outdoors with a high pH of 7. Hydroponic tomatoes are at their best in more acidic conditions, ideally with a pH of 6.0 to 6.5. Cabbage will do okay in alkaline soil with a pH as high as 7.5. Grown hydroponically, they're at their best grown in neutral (7.0) to slightly acidic (6.5) solution.

CONCLUSIONS

Hydroponics is a great alternative to the current farming methods and can improve food security. Here are several reasons why this is the case:

- It doesn't rely on soil
- It doesn't depend on low welfare standards
- It doesn't depend on high feedstuff input
- Prolific chemical use to meet margins is not required

Hydroponics mimics biology and can be used on a small scale in your own backyard or house, and also on a community level which would educate and enable people to grow their own food to benefit many on a personal and economic scale.

- The observation of growth of a plant is simply which are given 2 plant observation on the date conducted 4/01/2018, one of tulsi and other are snake plant which having good condition of plant were alive and vegetated after installing ,growth continuous in the progress new leaves showed in aesthetically good

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