

# Hydroponics: a Significant Method for Phytoremediation- A Concise Review

Kirti Pandya<sup>1</sup>, Sanjukta Rajhans<sup>2</sup> and Himanshu Pandya<sup>3</sup>

Department of Botany, Bioinformatics and Climate Change Impacts Management

School of Science, Gujarat University, Ahmedabad, Gujarat, India

kirtipandya99@gmail.com

**Abstract:** *The greatest available resource for the growth of plant is soil. In addition to anchorage, soil provides nutrients to plants. There are several limiting factors like disease-causing microorganisms, decrease in the soil fertility, erosion of top soil, lack of proper drainage of soil etc. which causes hindrance in the growth of plants. Other factors such as requirement of water facilities in abundance, bigger area for cultivation practices and adequate labour creates difficulties for growing crops in the fields. The situation gets tougher in the urban areas where there is limited area for cultivation. The variation in different geographic and topographic factors also lead in creation of unavailable land area for cultivation. Due to all these reasons soil less cultivation has emerged as the ray of hope. In this paper we have discussed about the advantages of hydroponics and how it can be one of the best alternative methods for phytoremediation.*

**Keywords:** Hydroponics, Nutriculture, Wasteland, Premium

## I. INTRODUCTION

Nutriculture implies to all such techniques which are used for growing various plants species in a media containing water and nutrients (Hoagland&Arnon,1950). In this process the roots of the plants are generally immersed into the solution containing different minerals. Another popular name of this method is 'Hydroponics', which is a Greek word in which "Hydro" means "water" and "ponos" means "labour" (Sengupta & Banerjee, 2012). This method involves growing plants in nutritious solution in presence or absence of inert materials such as gravel, rockwool, perlite, hydroton, coir, vermiculite, brick shards etc. (Pandey *et al.*, 2009). The popularity of this method is due to its proper management of natural resources.

### Factors on which the Method of Hydroponics Depends-

- A) Available space
- B) Predictive productivity
- C) Appropriate growing medium and
- D) Good quality of produce

The hydroponics technique consists of different methods including open and closed system (Sardare&Admane, 2016).

1. Open System- The open system is also referred to as static or non-circulating culture system (Sengupta&Banerjee,2012). It includes other methods such as root dipping, capillary action, floating technique etc. The non-circulating system requires containers or vessels.
2. Closed System- The closed system contains nutritive solution circulating inside the medium. This system is controlled automatically and requires periodic observations. The roots are provided with continuous supply of nutrients. The closed system is categorised as Nutrient film technique and deep flow technique (Sengupta&Banerjee, 2012).

The amount of nutrient solution and number of times the solution is supplied to plants in hydroponics depends on different factors including- variety of substrate, the method of irrigation system used in it, the species of crop, the physical and chemical properties of the substrate.

The plant should be provided with nutrition every day (Sengupta&Banerjee, 2012). The important parameters also include the pH of the medium and the physical and chemical properties of the substrate.

**Advantages of Hydroponics**

After China, India is the second most densely populated country in the world. The rise in population and the requirements of people are increasing day by day. Every citizen needs the basic necessities of life i.e., food, clothing and shelter. There is increase in the land requirement due to this. Urbanization and industrialization also lead to decrease in the stretch of cultivable land. Therefore, for all these problems where land for cultivation is becoming limited, hydroponics emerges as a better solution. The method of hydroponics is rapidly expanding due to its various advantages (Pandey *et al.*, 2009). Hydroponics evolved in India with the aim of gathering the needs of Indians. Even if the soil may not be fertile, hydroponics can bring the uncultivated and wasteland under cultivation. In comparison to soil the maintenance is low and can be very useful for growing crops even in indoor areas.

**Phytoremediation**

Phytoremediation is the technique which uses plants for removing heavy metals from the soil. It is an eco- friendly method by which the heavy metals get deposited in the various plant parts. Phytoremediation using pot culture technique involves the application of heavy metals as stress. We know that the soil is non-renewable resource which needs to be protected. Application of heavy metals to soil pollutes it. Post treatment involves testing the soil. The amount or content of trace element present in the soil can be determined using various methods such as atomic absorption spectrometry (Ure, A. M., 1990). The AAS (Atomic absorption spectrometry) involves digestion using strong acids such as concentrated Hydrochloric acid (conc. HCl) and concentrated Nitric acid (conc. HNO<sub>3</sub>) in the ratio of 3:1 (Ure, A. M., 1990). The technique of acid digestion is risky and hazardous. The Atomic Absorption Spectrometry is implied for soil. Furthermore, after the treatment of soil, disposal and discarding of such toxic soil becomes a big problem. The heavy metal soil waste should be discarded after making it less toxic. So, pot culture experiments are a bit harmful and the growth of the plant can be slow.

**Hydroponics as an Alternative for Pot Culture**

Phytoremediation using hydroponics can be the best alternative for all the above-mentioned problems-

The technology is very convenient. The most important benefit of hydroponics is that the plants can be grown in very less amount of available space in comparison to the field area (Pandey *et al.*, 2009). There is no possibility of weed invasion, attack by pests, pathogens and diseases. Sometimes eradication of weeds in large fields becomes a problem due to high cost. So, hydroponics technique is the remedy for weed prevention. The time required for growing of various crops used in remediation purpose is less using the method of hydroponics. Fast growth can be induced because the roots of the plants are directly in contact with the nutrients provided at regular intervals. Light is very important for healthy growth of plants. Light is one of the important parameters for growth and photosynthesis. In indoor areas light intensity increases. All plants have different requirements of light for example light period, dark period and neutral period. Thus, to eradicate the above mentioned problems, hydroponics is the best solution. The light requirements can also be adjusted according to the plant with the help of artificial lightening. Moreover, manual work compared to field work is reduced in hydroponics.

The greatest advantage of using hydroponics is the conservation of water. The technique saves a lot of water. The problem of waterlogging does not take place (Pandey *et al.*, 2009). The capital or money is saved as it involves reprocessing of nutrient solution as well as water. In the hydroponics system such as nutrient film technique, the nutrient is reprocessed and further loss is prevented. As we know root is the organ of absorption, healthy roots can be encouraged by checking various parameters at intervals. Non- seasonal crops can be promoted using this technique. The crops obtained are of premium quality without any particles of soil and dirt. It is the best technique which can be employed in agronomics and biological researches.

**II. CONCLUSION**

Hydroponics technique is very advantageous as it can provide quality crops in limited space, and resources. It is the ray of hope for all those situations where availability of soil is limited. Moreover, this technique does not depend upon the seasonal and climatic factors. Here, in this paper one more profitable role that has been highlighted is that, this technique can be opted as an alternative to the pot cultures used for the phytoremediation purpose. Thus, in future

studies use of hydroponics technique for phytoremediation is highly encouraged and many new scientific studies can emerge as an outcome of this application.

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