Volume 2, Issue 5, May - 2024
**ISSN (E):** 2938-3781



Web of Agriculture: Journal of Agriculture and Biological Sciences
webofjournals.com/index.php/8

# THE EFFECTIVENESS OF ORNAMENTAL PLANTS IN BIOLOGICAL TREATMENTS TO GET RID OF POLLUTANTS

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**Abstract**
Air pollution is one of the most dangerous and important problems in the world and a source of great concern for many developing and developed countries, especially in urban areas. Given its impact on the environment and human, animal and plant health, the current article provides a brief review of air pollution, and the effect of plants as a bio remedial agent to get rid of air pollutants. And the heavy elements found in the soil and the most important plants that resist pollution. The cause of air and soil pollution may be due to the increase in population growth, the high rate of industry, and the absence of adequate planning and environmental awareness related to development, development, and consumption. These factors contribute to the increase in the percentage of pollution.

**Keywords**: ornamental plants, pollution, biological treatment.

## Introduction

Air is the basis for the continuation of human life, as the limits of a person's need for air exceed the limits of his consumption of water and food. Clean air is a mixture of gases that include nitrogen by 78%, oxygen by 21%, carbon dioxide by 0.03%, water vapor by 1.3%, and small percentages of helium, hydrogen, and ozone. (Vallero, 2008).Air pollution, that is, the unusual fluctuation occurring in any component of clean air above the normal value, constitutes a serious problem for the environment and public health, and reducing it constitutes a challenge in all countries (Rossini, 2023)

In addition to the fact that air pollution It is a multi-stress factor, as it releases into the air many types of pollutant gases such as (NOx, Sox and (VOCs) Volatile organic compounds) and particulate matter such as heavy metals and polycyclic aromatic compounds (Isichei and Raimi, 2015 and Kim, 2014)

Accordingly, pollutants are classified according to their origin into primary pollutants, which are substances emitted directly into the atmosphere from natural sources or human activity, including scattered ash and carbon monoxide gas emitted from car exhausts and carbon dioxide emitted from factories. Secondary pollutants are substances that are not emitted into the atmosphere. The air directly, but from the interaction of primary pollutants with each other or with natural components of the atmosphere, such as the reaction of sulfur dioxide with oxygen to form sulfur trioxide, and

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**ISSN (E):** 2938-3781


the reaction of the latter in turn with water vapor in the air to form sulfuric acid (Jose et al., 2021 and Torpy, 2014)

The World Health Organization estimated in 2005 that approximately 4 million people die prematurely every year due to indoor air pollution in all parts of the world annually. Most of these cases appear among societies of industrialized countries as a result of the emission of smoke and dusty materials with a diameter of less than 2.5 micrometers, which have the ability to penetrate. It enters the lung tissue and settles in it. It was also found that about half of the deaths of children under five years of age due to pneumonia are due to inhaling fine particles resulting from indoor air pollution (Yue et al., 2021 and El-Tanbouly et al., 2021)

The major role of plants in air pollution studies lies in several directions. Firstly, it gives an indication or early warning of the presence of a pollution situation in a specific area, and thus it also helps in evaluating the air quality there (Wagh et al., 2006), as it was found that plants are able to trap fine particles and accumulate them. PTE (potentially toxic elements) pollutants that may be absorbed or accumulated internally (Gawronski, 2017), Plants remove PM mainly by absorbing them on their surface (leaves or shoots) and fixing the PM in the wax layers (Lee et al., 2020), therefore, part of the PM (Particulate matter) adheres to the waxy surface of the leaves while some also penetrates the wax layer. The plant acts as a biological filter to purify indoor air, and this process is environmentally friendly, sustainable, low-cost, and easy to use (Dzierżanowski et al., 2011and Oh et al., 2011)

**Plant bioremediation of pollutants**

Plants are very important in maintaining environmental balance by creating a healthy and clean environment for human life, as plants are the largest centers of oxygen on Earth, as they are constantly supplied with infinite amounts of free oxygen (Indira et al., 2015 and Kankaria, 2014), where it is used Vegetative cover to reduce the effect of dust and pollutants. This process is called phytofiltration.

The wide green plant belt (8 m) can reduce approximately half to two-thirds of the falling dust. Appearance characteristics such as the arrangement of the leaf on the branches, the size and shape of the leaf, the nature of the surface, and the presence and absence of Surface coating and deposition of waxy materials are important factors on which the plant filtration process depends to trap dust from the surrounding air (Tripathi and Singh, 2007 and Lin, 2020).

Once the pollutants penetrate the plants, they will face a wide range of internal physiological activities before they are removed. These activities include the chemical transformation of the pollutants, their storage, or their participation in metabolic pathways, especially the pollutants consisting of the elements sulfur and nitrogen, which will be translated in the form of a physiological response of the plant, such as respiration, photosynthesis, transport, and transpiration. Perhaps it will result in a visible response to the plant, such as premature aging or death (Sabri et al., 2014 and Deng, 2018 ) or the effect of pollutants on the cuticle layer in the leaves by breaking and destroying it, which facilitates the penetration of pollutants into the tissues and inhibits the work of stomata, causing Reducing its resistance to water loss and drought, thus reducing the leaf area and reducing the number and diameter of stomata (Larcher, 2003 and Isbill et al. 2020)


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**Conditions that must be met by plants for biomonitoring**

The high-quality plants planted on the sides of roads, in city squares and gardens, and inside homes represent the organisms that have the best effect on pollution, as research indicates that plants interact with heavy metals found on the side of the road or with air pollutants (Verma et al., 2013), so the use of plants gives a much better picture. of devices on pollution because they detect the state of pollution whenever it occurs other than the use of devices (Wolterbeek, 2002)

The following is required for plants to be good biological environmental monitors: (Alwan & Hamad,2020)

- It must be widely distributed in the environment under study (spatial availability).
- Availability throughout the days and seasons of the year (temporal availability)
- Its content of the studied pollutant is proportional to its level in its environment.
- The ability to accumulate pollutants.
- Easily recognizable and distinguishable in the field.
- It should be quick to respond, so that it gives the researcher the ability to predict how stress will affect species or ecosystems.
- Ease of taking samples and repeating them throughout the year in order to identify temporal changes.
- It should be affordable and cheap

There are many plant parts that can be used to monitor the environment, including: (Nwadinigwe, 2014)

• Leaves
• The stems
• The stems rings
• The bark

**Mechanism for dealing with soil pollutants**

**- Phytostabilization**

The basis of this process is the use of plants to restrict the movement and readiness of pollutants in the soil through the roots (Shakoor et al., 2013).

**- Phytoextraction**

Plants can be used to remove heavy elements from the soil, as plants work to absorb relatively high concentrations of heavy elements and transfer them to the branches or to different plant parts to collect in them, and then get rid of these plants (Nowak, 2007).

**-Rhizofiltration**

It is intended to be used by aquatic plants to absorb heavy metals and pollutants present in aquatic environments (Rajakaruna et al., 2006).

**- Phytogradation**

It includes the process of absorbing pollutants by plants and then destroying these pollutants through metabolic processes that take place inside plants, or destroying external pollutants through

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the influence of compounds secreted by plant roots, such as enzymes (Mansour, 2014).

**- Phytovolatilization**

It means using plants that absorb pollutants and polluting elements and then transform them and release them into less toxic forms. One of its applications is getting rid of mercury, as mercury transmitted to the air through plants is less dangerous than its form in the soil (Pandya et al, 2013).

**Mechanism for dealing with air pollutants**

Plants absorb volatile organic compounds from the air into their leaves and then transport them to their root zone, where microbes break them down. Soil microorganisms can use trace amounts of pollutants as a food source (Vazquez, 2014).

Some of the organic chemicals that plants absorb from the air are destroyed by the plant's own biological processes, The plant's roots absorb the water solutions in the rooting medium. Since air also reaches the plant's roots, absorption by root tissue is another way by which can purify the air. (Larcher, 2003 and Jo et al., 2019) During the process of photosynthesis, carbon dioxide is absorbed by the plant leaves, and oxygen is produced and released by the plant as a byproduct. At night or when photosynthesis is not taking place, plants breathe, such as Humans release carbon dioxide. Volatile phytochemicals released by plant leaves have been found to be important in controlling airborne microbes and mold spores in the surrounding air (Jasim, 2018).

Plants release water vapor through transpiration through the leaves and into the air, increasing humidity. High transpiration rates create convection currents that cause air laden with toxins to be drawn into the soil around the roots, where microbes in the soil break down the gases into a food source. And energy also moves the air in and out of the leaf stomata (Kobayashi et al., 2007and Bunce, 2020)

**Pollution-resistant plants**

Plants that have been proven to be effective in cleaning indoor and outdoor air, as they have the ability to absorb and destroy various toxic elements and substances present in the environment, is called phytotherapy, in addition to the accumulation of particles and dust, although plants are still not present well within indoor environments or are not used as they should. The best way to purify outdoor air (Pramitha and Haryanto, 2019 and Maynard, 2019) as well as plants are listed in Table No. (1)

Table (1) the most important pollution-resistant plants

| Plant name | Description | Plant name | Description |
|---|---|---|---|
| *Areca palm* (butterfly palm), Dypsis lutescens | Clusters of erect, slender, cane-like stalks with feathery yellow-green fronds | Florist's mum, *Chrysanthemum morifolium* | Produces a brilliant display of colorful flowers. |
| *Bamboo palm*, Chamadorea elegans or C. erumpens | Clusters of small slender canes. Graceful fans with rich green color | *Gerbera daisy*, Gerbera jamesonii | Sturdy stems that have colorful flowers. Leathery leaves. |
| *Boston fern*, Nephrolepis exaltata | Stiff fronds arch outwards, drooping downward as they age. | *Golden pothos*, Epipremnum aureum | Vine with green heart-shaped leaves with gold or cream colors. |



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| | | | |
|---|---|---|---|
| Corn plant, *Dracaena fragrans* 'Massangeana' | Shiny medium green leaves with a bold yellow-white stripe down the center. Develops a solid woody stem. Leaves concentrate at the top of each stem. | *Kimberley queen* fern, Nephrolepis obliterrata | Fern with graceful, drooping fronds and lush green foliage. |
| *Dendrobium orchid* | Has beautiful exotic blooms, usually in clusters or in a row along canes. | King of hearts, *Homalomena wallisii* | Dark, olive-green, oval-shaped leaves with areas of silver or cream. Leaves 8 inches long. |
| *Dracaena deremensis* 'Janet Craig' | Erect stems with a rosette of broad, smooth, glossy, dark green leaves 12 inches long and 2 inches wide | Lady palm, *Rhapis excelsa* or R. humilis | Large palm with fans 6 to 12 inches wide with 4 to 10 thick shiny leaves. Brown hairy main trunk with thin arching stems. |
| *Dracaena deremensis* 'Warneckei' | Leaves, 2 feet long and 2 inches wide, are green with white and gray-green stripes. | *Lily turf*, Liriope muscari | Grassy arching evergreen leaves reaching 6 to 18 inches long. May be dark green or variegated. |
| Dragon tree, *Dracaena marginata* | Smooth, gray, erect canes. Leaves, 2 feet long and 1/2 inch wide, are deep, glossy green with red edges along the margins. Leaves cluster at the end of each cane. | *Peace lily* (White flag), Spathiphyllum varieties | Sends up stiff erect stalks that produce beautiful white spathes. Dark green leaves stand erect in the juvenile stage, but start to bend as they mature. |
| Plant name | Description | Plant name | Description |
| Dumbcane, *Dieffenbachia varieties* | Wide, blotched green and white (cream) leaves. Unbranched stems arch downward. | *Philodendron erubescens** 'Red Emerald' | Vining habit. Burgundy-red leaves are long and narrow with yellow veins. |
| Dwarf date palm, *Phoenix roebelini* | Stately main trunk with graceful, green fans that droop elegantly. Fronds reach 3 feet and grow horizontally. | Rubber plant, *Ficus elastica* | Thick, leather-like, glossy, dark-green leaves that contain a rubber-like latex. |
| English ivy, *Hedera helix** | Vigorous climber which sends out aerial roots that attach to any surface. Dark green leaves have 3 to 5 lobes | *Schefflera* (umbrella tree), Brassaia actinophylla* | Has long stems with 7 to 16 deep green leaves, each up to 12 inches long. |
| *Ficus bennendijkii* 'Alii | Slender dark green leaves. | Spider plant (airplane plant), *Chlorophytum comosum* | Sends up slender, arching shoots with leaves that may be green or green with a broad center stripe of yellow or cream Leaves 6–12 inches long.. |
| Weeping fig, Ficus benjamina* | Treelike growth habit. Graceful drooping branches. Small, dark green, pointed, glossy leaves. | *Ranunculusasiaticus* | Ranunculus asiaticus, is a species of buttercup native to the eastern Mediterranean region, southwestern Asia, southeastern Europe, and northeastern Africa. It is a herbaceous perennial plant growing up to 45 cm tall, |

(Gilhooley,2002 and Berry et al.,2020 and Su and Lin , 2015 and Berteroet al .,2020 and Bhargava et al .,2021 and Han et al.,2022 and Zhang et al .2021 and Llewellyn and Dixon.2011and Alwan and Sadiq,2019 and Khudhair ,2022 and Brilli,2018and Hui,2017 and Alwan et al ,2023) and Khudhair,2020

## CONCLUSION

The plant acts as a biological filter to purify the air and this process is environmentally friendly, sustainable, low cost and easy to use.

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**ISSN (E):** 2938-3781



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