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Studies on Ornamental Plants as a Natural Air Purifier

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Abstract
Air Pollution refers to the physical, chemical and biological characteristics of air in the outdoorand indoor environment. Poor air quality is responsible for numerous diseases of the upper and lower respiratory tract, headaches, rhinitis, allergies and skin changes. The most well-known phenomenon associated with poor air quality is the so-called sick building syndrome. Improvement of ambient air quality of environment involves the basic approaches like emission reduction at source level, conversion of pollutants to a less damaging compounds and sequestration of pollutants. However, in order to manage the air quality, application of ornamental plants may be considered a well alternative approach. Plants play an important role in monitoring and maintaining the ecological balance by their involvement in the cycling of nutrients and gases like carbon dioxide and oxygen. Many species of ornamental shrubs and herbaceous landscape plants have been identified as phytoremedator to improve indoor and outdoor air quality. Plants remove a significant amount of pollution from the atmosphere as part of their normal functioning. Plants reduce the concentration of greenhouse gases and their consequence on climate change. The possible application of ornamental plants, which may be trees, shrubs or herbs to regulate air quality. Some selective plant species has also been recommended based on its air pollution tolerance index. NASA has listed various plants such as Areca Palm, Lady Palm, Bamboo Palm, Rubber Plant, Dracaena, English Ivy, Dwarf Date Palm, Bostorn Fern, Peace lily that can successfully help to reduce the level of Indoor Air Pollution. So plant these ornamental plants to purify your surroundings and breathe a fresh air.

Key words: *Ornamental, pollution, air, indoor*

India is blessed with various agro-climatic regions and in every part of India almost different type of plants are grown. Every single plant not only looks different from others but also has enormous features and utilities. As it is estimated that Indian flora comprises of nearly 2000 species belonging to 150 families of flowering plants. The vast diversity ranks the 10th in the world (Kishwan et al., 2009). In cities and industrial areas certain proportion of land can be managed by growing some ornamentals. These ornamentals either may be trees, shrubs, climbers, ground covers or grasses which occupy a certain proportion of landscaping and become an important and integral part of that area. Scientific management of landscape techniques and selection of plant species has also opened the doors to minimize the deleterious effects of air pollutions in these areas. The awareness of growing ornamental plants for improvement of air quality is lacking in developing countries like India and there is a complete neglect of air quality improvement planning in big cities and near the industrial areas across the country. In view of the above, this paper will find out the possibility of using ornamental plant as an alternative approach for the management of ambient air quality Human beings need a regular supply of food and water and an essentially continuous.

Pollutants are the substances that contaminate air, water and or soil. The most potential toxic elements in the air are the non-radioactive As, Cd, Cu, Hg, Pb and Zn and radioactive Sr, Cs and U (referred to here as toxic metals). Also, nitrogen dioxide (NO2), Carbon Monoxide (CO), and Hydrocarbons (HC) are considered the main emissions, and higher levels can often be the result of increased airport vehicular traffic (Yang and Liu, 2011) Pollutants are not necessarily born as pollutants. On the contrary, they may be resources applied in the wrong places. Incorrect uses, accidental releases and/or technical limits make them harmful to our environment (Zhai, 2011). The requirements for air and water are relatively constant (10–20 m3 and 1–2 litres per day, respectively). That all people should have free access to air and water of acceptable quality is a fundamental human right. That people are exposed to air pollutants both outdoors and indoors is obvious. Globally, people are spending an increasing amount of time indoors. There they are exposed to pollutants generated outdoors that penetrate to the indoor environment and also to pollutants produced indoors, for example as a result of space heating, cooking and other indoor activities, or emitted from products used indoors.

Air pollution had spread around the world like an evil with rapid urbanization and industrialization, it has resulted in various health problems for man such as respiratory, cardiovascular and ophthalmic diseases (Brunekreef and Holgate, 2002; Miller et al., 2007; Nandasena, 2010; Giles et al., 2011; Gudmundsson, 2011; Jamrozik and Musk, 2011). The significant air pollutants are suspended particles, gases, different ionizing radiation and noise. The gases include the oxidized and reduced forms of nitrogen, Carbon, SO2, C6H6, Vapour, O3,

Hg, Cl2, and volatile phenols. The suspended particles include the various forms of PM2.5, PM10 particulate and heavy metals.

The increase in population, industrialization and commercialization in urban areas has led to a rapid repercussion in the surrounding environment. Ambient air pollution has become a matter of

great concern, particularly in mega cities and urban areas and rapid industrial development coupled with emission from transport sector are recognized as the prime sources. The situation is

alarming and gradually becoming more severe and it is expected to increase in near future to cope up with the population expansion (Banerjee et al., 2011). Therefore, development of an adequate management plan is one of the most basic requirements for the well beings of human, animals as well as for plants. Air pollution can build up in any confined space, but gases from synthetic materials used these days to construct or furnish offices and homes can, among other factors, result in "sick building syndrome." While some people exposed to sick building syndrome will be unaffected, others who are hypersensitive to the pollutants can develop serious symptoms including eye, nose, and throat irritations, allergies, asthma, blurred vision, dizziness, fatigue, headache, skin irritation, nervous system disorders, and upper respiratory and sinus congestion.

Ornamental Plant Species Ideal for Improvement of Indoor Air Quality

Aloe Vera - *Aloe barbadensis,* Ghi Kanvar Aloe vera is a succulent plant species. It cleans the air perfectly. A single Aloe Vera plant can refresh any small apartment. Itremoves formaldehyde effectively from indoor air. It is also own for its healing properties. It can treat burns and colds. Keep it on the kitchen window sill as it has the quality of absorbing formaldehyde produces from natural gas from gas stove and kerosene.

Peace Lily – *Spathiphyllum*

Pollutants like benzene, toluene, xylene, ammonia, formaldehyde and trichloroethylene are successfully filtered out by the beautiful Peace lily houseplant. Keep it near carpeting, rubber, dry-cleaned items, tobacco smoke, gasoline, synthetic fibres, plastics, ink paints, varnishes, lacquers, oils and detergents.

Spider Plant – *Chlorophytumcomosum,* ribbon plant, spider ivy

The spider plant absorbs all the chemicals spray while cleaning the apartment. This plant is very simple and ndemanding. Very popular garden plant. It does not require much watering and is very adaptable for hanging basket. Keep it near carpeting, bathroom or window facing traffic/road.

Money Plant – *Epipiremnum Aureum,* Golden Pothos, Devil's ivy

This plant acts as an excellent natural anti-pollutant against common pollutants like benzene, formaldehyde and carbon monoxide. Keep it in a bedroom, where it is best suited and which is usually closed for long duration during the day time when we are away. We may also place it near the furniture.

Snake Plant – *Sansevieria laurentii,* mother-in-law's tongue

They help remove benzene, formaldehyde, trichloroethylene and xylene from indoor air. This plant can be seen everywhere, mostly in offices and restaurants. It requires almost no care. It only needs to be watered about once a month. It likes dry air and little sunlight. Keep it near carpeting and rubber based or dry cleaned items.

Chinese Evergreen – *Aglaonema modestum*

Emits high oxygen content, and purifies indoor air by removing chemicals, such as formaldehyde, benzene or other toxins. They are thought to bring good luck and were used as decoration in Asian countries long before they made it west. Keep it near gasoline sources and carpeting.

Dumb Cane – *Dieffenbachia* hybrids**,** Leopard Lily

Its large leaf surface area helps it to quickly remove air contaminants from indoor spaces. These are poisonous and avoid coming into contact with the sap and if so, wash it off before accidentally rub eye or somewhere equally unfortunate. Keep it near the furniture. Apart from these plants, all species of Dracaena and Bamboo palm are very easy to grow and they help in

removing volatile airborne pollutants and a wide range of chemical vapours.

How to Place Them

As a rule of thumb, in an 8-foot ceiling house, 2-3 plants in 6x8-inch pots will clean 100 square feet of space. The more vigorous the plant, the more air it can filter. When positioning the plants, try to strike a balance between light and ventilation because the effect of plants on indoor air pollution appears to be reduced if they are set in a draft. Place a plant within "personal breathing zone", a space 6x8 cubic feet around where we can

work at our computer, watch TV, or sleep. Plants placed within this zone can add humidity, remove bio-effluents and chemical toxins and suppress airborne microbes. Placing several inches of aquarium gravel over the soil in the plant container will help prevent the formation of molds, a common allergen.

Indoor air quality improvement ways

There are various ways to reduce indoor air pollution and improve air quality. Increasing ventilation and air exchange with the outside will help prevent the accumulation or reduce the amount of air pollutants indoors. In the case of sulfur dioxide emitted by volcanoes, it is advisable to close up the house if the vog episode is particularly bad. Exhaust fans can be installed in the kitchen and bathrooms, and air filters such as high-efficiency particulate air (HEPA) filters, which have a carbon filter component, can be used. Combustion appliances should be vented directly to the outside and regularly inspected, cleaned, and maintained. A byproduct of propane gas combustion is carbon monoxide. The house should be well ventilated when cooking or heating with propane. Use only wood products that are formaldehyde-free or have low formaldehyde emissions. Seal the surfaces of wood products with surface finishes that are water-based. Select low-emission building products and carpets. Avoid household products that have hazardous vapors, and do not store hazardous products in the home. Product lines marketed as "eco-friendly" can be found at natural food stores and are becoming more readily available at mainstream supermarkets. Air out carpeting and other building materials before they are installed. (Lohr et al., 1994)

Advantages of house plants to purifier the air

One of the major benefits of house plants is that they can work in virtually any space. House plants are particularly effective as a living air purifier in enclosed spaces, such as home and kitchens. House plants can also fit into spaces that many times will not accommodate an air purifier. Also house plants are a cost effective solution while air purifiers can be pricey especially for the consumer who may need more than one. One of the unintended benefits of house plants is that they can include a wide range of psychological and physiological effects. Plants can not only add beauty to a room, but also make it a friendly and inviting place to live or work. Plants may symbolize friendship and appear to have calming, spiritual effect on most people. The trend of using house plants for decoration and air purifying has moved into the corporate and retail world as well. Corporations have begun to install interior landscaping to increase worker productivity and decrease absenteeism. Elite hotels, restaurants and other businesses use plants to help entice customers into their establishments. We can all breathe easier realizing the many benefits of house plants.

Source and Effects Air Pollutants

Some natural factor also affects the air quality viz. Volcano which produces chlorine, ash particles and sulphur. Wildfire produces carbon monoxide and smog. Pine plant produce volatile organic compounds. Cattle and other animal produce methane gas. In urban areas, combustion of fossil fuels to generate electricity, in industrial processes, transportation and space heating is the predominant anthropogenic source of atmospheric air pollutants (CO, NO2, SO2, TSPM etc.). The burning of hydrocarbons in motor vehicle engines gives rise to CO2, CO, SO2, NO*x* in varying proportions and C2H4, as well as a variety of other hydrocarbons. Additional SO2 originates from domestic and industrial burning of fossil fuels. Industrial plants, such as chemical and metal-smelting plants, release SO2, H2S, NO2, and HF (hydrogen fluoride) into the atmosphere. (Miller *et al*., 2007) TSPM are diverse in physical and chemical properties depending on their source (stationary, mobile or natural), geography and meteorology of the particular area. The sources, characteristics and potential health effects of PM10 (particles with aerodynamic diameter less than 10 mm) and PM2.5 (particles with aerodynamic diameter less than 2.5 mm or fine particles) are very different. Epidemiological studies emphasized that exposure to airborne particles with aerodynamic diameter less than 10 μm (Respirable Particulate Matter, RPM) induce negative health impacts and adverse meteorological factors may aggravate such kind of exposure. In addition to these, particulates are also responsible for causing reduced visibility and changes in the nutrient balance both through wet as well as dry deposition processes.

Table.1 Major air pollutants in the environment, pollutant sources and their effect on public health

Outdoor pollutant	Pollutant sources	Health problem
Carbon Monoxide	Burning diesel, petroleum and wood	Increases confusion, sleepiness, low blood oxygen level, slow reflexes
Carbon dioxide	Burning oil, coal and natural gases	Lowers oxygen levels, vision defects, reduces respiratory and brain functions,
Nitrogen dioxide (NO2)	Burning fuels, electricity generation plus vehicle engines,	defect in lung function and causes bronchitis in asthmatic children, toxic
Sulphur dioxide (SO2)	industrial processes, and Burning fossil fuels	eye irritation and respiratory inflammation, asthma attacks,, mucus secretion, decreases pulmonary function.
Ozone (O3)	photochemical smog produced by the interaction of sunlight and air pollutants	photochemical smog produced by the interaction of sunlight and air pollutants
Suspended particulate matter (PM10, PM2.5, SPM)	Mixture of solid and liquid organic plus inorganic materials including nitrates, sulphate, carbon, sodium chloride, ammonia, mineral dust and water	Disrupts lung's gas exchange function and respiratory illness

(Kapoor, 2017)

Conclusion

It is well understood that such ornamental plants are well applicable as a supplementary approach for mprovement of air quality and therefore it was felt necessary to adapt such practices in urban environment. Ornamental plants play an important role in monitoring and maintaining the ecological balance by their involvement in the cycling of nutrients and gases like carbon dioxide and oxygen. The applicability of ornamental plants as an approach for air quality management and several plant species can be used.

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