

Interior Scaping for a Better Living-A Review

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Abstract

With the rapid urbanization and population explosion, the air quality has declined over the years which have resulted in stress, depression and multiple respiratory diseases. As density of people has increased over a given area, proportionately the need of clean and fresh air has also increased. Horticulture science has come up with very unique idea of interiorscaping as a solution to all problems. Plants not only help to groom the interiors but also contribute to the psychological well-being of humans. Indoor plants play a significant role in improving indoor air quality, due to their capacity to absorb toxins and carbon dioxide and regulating the humidity level. The use of indoor plants could prove to be a cost-efficient way of indoor air-purification that could be adapted for a variety of environments and can also add an aesthetic value that can have an indirect impact on human health. Many species of ornamental shrubs and herbaceous landscape plants have been identified as phytoremediator to improve indoor and outdoor air quality. During the Covid-19 pandemic, the use of indoor plants has gained attention as a new possible eco-friendly tool for indoor air purification and for reducing the spread of COVID-19 in confined places. The goal is to create a synergetic environment for both plants and humans.

Keywords: Foliage plants, Horticulture, human well-being, indoor plants, aesthetic value.

Introduction

Indoor plants have been an integral part of our lives providing environmental, economic and social benefits to the society. Plants have been rightly called as the ‘lungs of the cities’ due to their ability to combat pollution (Mcpherson, 2005). The global death toll was estimated to be more than 4.2 million people who are indirectly related to

indoor air pollution (World Health Organization, 2021). Out of this, 8% suffered from lung cancer, 18% had stroke, 27% ischemia heart problem, 20% chronic obstructive pulmonary disease and 27% pneumonia. The declining indoor air quality are driven by factor such as chemicals present in household products, burning of solid fuels for cooking and heating in households, molds present in home, increasing air temperature, high humidity, etc. All these factors collectively contribute to a phenomenon known as the 'sick building syndrome'. Indoor air quality (IAQ) has become a grave cause of concern, as it is two to five times worse than the ambient air. Facing the potentially deadly air quality outside, with the rise in pollution levels in urban areas, people are now desperate and ready to pay to breathe in clean air. To deal with such situation, the first oxygen bar 'Oxy Pure' was started by Aryavir Kumar and Margarita Kuritsyana in 2019 at New Delhi where one had to pay Rs 300 to 500 to inhale 80 to 90 per cent pure oxygen air, fused with different essential oils for about 15 minutes. However, it is not possible for all section of people to pay for a breathable air.

In January 2019, when nearly 102 cities in India failed to comply with the air pollution standards, the Ministry of Environment, Forest and Climate Change (MoEFCC) launched National Clean Air Programme (NCAP) with an aim to improve air quality and to achieve reductions up to 40% or achievement of National Ambient Air Quality Standards for Particulate Matter₁₀ (PM₁₀) concentrations by 2025-26. The fact that indoor air pollution is a realistic threat to human health as agreed by environmental scientists and government agencies, the question now arises as to how the problem can be solved.

Interior scaping is one of the most promising and economical solution for alleviating the 'sick building syndrome' associated with many new, energy efficient buildings. It involves the art of growing and arranging plants indoor or in the house for its best use for function and its aesthetic value. It is the least expensive way to clean the air and keep the human bodies fresh and in healthy working state. This works on the concept that the plant root soil zone is the most effective area that destroys the pathogenic viruses, bacteria, and the organic chemicals, which eventually converts all of these air pollutants into new plant tissue. Trees works as the air purifiers of the atmosphere and indoor plants functions the same way but inside a closed space. These plants absorb noise as well hence help in reduction of noise pollution.

Many scientific studies today describe the interactions between people and plants, both inside and outside. A wide range of advantages have been identified, including better air quality (Wood et al., 2002), less stress (Dijkstra et al., 2008), and quicker recovery from illness. An increase in the usage of plants to address environmental and health issues is being attributed to studies based on their advantages. The tangible impacts, such as the elimination of air pollution, have a relatively well-understood physical source. The most efficient use of plants to address these concerns is hampered by a lack of theoretical grounding. This article reviews some of the research undertaken that have proven the health benefits of plants, with an emphasis on indoor plants. The objective is to illustrate the value of flowers, beautiful plants, and gardens as activities that promote wellbeing and sound mental health.

Indoor plants for a healthy lifestyle

Growing and maintaining indoor plants have emerged as a new way to a healthy lifestyle in a polluted indoor environment. It not only improves the indoor living space but also has a positive effect on human attitudes, behaviours and physiological responses, influencing overall health and happiness to a great extent. Due to the changing lifestyle, stress related disorders in work environments are on the rise and there is a need for understanding the relationship between plants and human well-being (Singh, 2023).

Improvement of Indoor Air Quality

Indoor plants are effective in phytoremediation that purifies the air and absorbs the harmful pollutants like ammonia, formaldehyde, carbon monoxide, benzene, etc. The bacteria that grow on the plant rhizosphere play a significant role in decreasing the pollution. As per the studies conducted by NASA, roughly two plants per 100 square feet are recommended to filter the air indoors. Early research on utilising plants to purify the air in space stations was financed by the U.S. National Aeronautics and Space Administration. The volatile organic compounds (VOCs), particulate matter, ozone and biological contaminants contribute to the air pollution indoors. Plants have the ability to either remove or lower down the level of VOCs (Volatile Organic Compounds) from indoors through stomatal uptake, absorption, and adsorption to plant surfaces. Hong et al. (2017) in their studies revealed that *Ficus spp.* had the ability to lower down the levels of VOCs pollutants in the room like benzene, ethylbenzene, xylene, styrene, formaldehyde, acetaldehyde, and toluene. Plant

species such as *Epipremnum aureum*, *Polypodium formosanum*, *Lavandula spp.*, *Selaginella tamariscina*, *Pteris multifida*, *Pelargonium spp.*, *Aloe vera* have been reported by Kim et al. (2010) to be effective in removing formaldehyde from indoor air. Aydogan and Montoya (2011) revealed the efficacy of plants such as *Hedera helix*, *Chrysanthemum morifolium*, *Dieffenbachia compacta*, and *Epipremnum aureum* in reducing the levels of formaldehyde upto 90% within 24 hours' time. A study conducted by Garg et al. (2021) have shown that benzene can be efficiently removed from indoor air by plants like *Aglaonema modestum*, *Aloe vera*, *Chrysanthemum morifolium*, *Dracaena marginata*, *Epipremnum aureum*, *Gerbera jamesonii*, *Hedera helix* and *Spathiphyllum wallisii*.

Table 1. Indoor plants suitable to combat air pollution

Plant species	Common name	Pollutants removed
Foliage plants		
<i>Aglaonema spp.</i>	Chinese evergreen	Benzene, formaldehyde
<i>Epipremnum aureum</i>	Money plant	Benzene, formaldehyde, xylene
<i>Chlorophytum comosum</i>	Spider plant	Benzene, formaldehyde, xylene, carbon monoxide, Sulphur dioxide
<i>Hedera helix</i>	English ivy	Benzene, formaldehyde, trichloroethylene, carbon monoxide, particulate matter
<i>Sansevieria trifasciata</i>	Snake plant	Benzene, formaldehyde, trichloroethylene, carbon dioxide
<i>Dracaena marginata</i>	Dragon plant	Formaldehyde, trichloroethylene, xylene
<i>Dypsis lutescens</i>	Areca palm	Acetone, xylene, formaldehyde, toluene
<i>Ficus elastica</i>	Indian rubber plant	Carbon dioxide, formaldehyde, benzene, xylene.
<i>Nephrolepis exaltata</i>	Boston fern	Formaldehyde, xylene, carbon monoxide
<i>Schefflera spp.</i>	Umbrella plant	Benzene, formaldehyde, toluene
<i>Ficus benjamina</i>	Weeping fig	Formaldehyde, xylene, toluene, Nitrous oxide
<i>Philodendron spp.</i>	Philodendron	Formaldehyde, benzene, carbon monoxide
<i>Aloevera spp.</i>	Aloevera	Formaldehyde, benzene

<i>Chamaedorea seifrizi</i>	Bamboo palm	Formaldehyde, toluene, xylene
Flowering plants		
<i>Gerbera jamesonii</i>	African Daisy	Benzene, formaldehyde, trichloroethylene
<i>Chrysanthemum morifolium</i>	Queen of the East	Benzene, formaldehyde, xylene, ammonia
<i>Spathiphyllum spp.</i>	Peace lily	Benzene, formaldehyde, trichloroethylene, xylene, toluene, Nitrous oxide
<i>Anthurium scherzianum</i>	Flamingo Lily	Benzene, trichloroethylene
<i>Dendrobium spp.</i>	Dendrobium orchid	Benzene, trichloroethylene, ammonia
<i>Phalaenopsis spp.</i>	Moth orchid	Benzene, trichloroethylene, ammonia

Increasing the relative humidity levels

High concentration of CO₂ coupled with low relative humidity levels can cause health issues in human beings. It has been reported by Gubb et al. (2018) that RH levels below 30% causes eye irritation and skin dryness and below 10% causes dryness of the nasal mucous membrane. On the other hand, high RH levels above 60 % encourages the microbial growth in the indoor space which deteriorates the building materials and makes the space damp and unhealthy (Bin, 2002; Zhang and Yoshino, 2010; Frankel et al., 2012). The relative humidity of the air should be within the recommended range of 30% to 60% for human comfort. It has been demonstrated by Gubb et al. (2018) that *Spathiphyllum wallisii* cultivars and *Hedera helix* had the highest transpiration rate suggesting its potential for increasing the relative humidity in indoor environment. In another study by Kerschen et al. (2016), it was recommended to place 25 spider plants (*Chlorophytum comosum*) in four inch-diameter pots for increasing the humidity levels of an interior bedroom from 20 % RH to a more comfortable 30% RH under bright interior light conditions. In a very recent study conducted by Ran (2024), placing of an evergreen indoor plant *Radermachera hainanensis* significantly led to a reduction in room temperature and increased the humidity levels.

Removal of Particulate Matter

The presence of particulate matters in the air poses a potential threat to human health resulting in about one in nine premature deaths worldwide. Most of the people spend their time indoors and are constantly exposed to particulate matter (PM).

Prolonged exposure to particulate matter can lead to heart attacks, respiratory problems, impaired lung functions and other health complications (Hamanaka et al., 2018, Baudet et al., 2022, Zhang et al., 2022). Indoor plants have been suggested as a potential solution for removing particulate matter indoors. Lohr and Pearson-Mims (1996) stated that particulate matter accumulation in indoor areas can be reduced to as low as 20% by placing the indoor plants. Broad leaved plants like *Ficus elastica* and *Ficus lyrata* with densely arranged grooves and ridges were known to remove particulate matter more effectively than the narrow leaved plants (Katoch and Kulshrestha, 2022). Budaniya and Rai (2023) opined that large numbers of indoor plants would be required to achieve even modest reductions in indoor PM concentrations. In the same year, Selvan et al. (2023) concluded that indoor plants viz. *Chrysalidocarpus lutescens*, *Epipremnum aureum* and *Sansevieria trifasciata* effectively removed the particulate matter from indoor environment.

Impact on the feeling of well-being

Ornamental plants are known to stimulate positive emotions by influencing directly human psychology and indirectly human health. Right selection of plants and its placement in the indoor environment is important to invoke positive feelings and comfort of the people (Yeo, 2020). A study conducted by Lohr and Pearson-Mims (2000) compared the effect of placing indoor plants, colourful objects and non-colourful objects on human feelings. It was concluded that in comparison to the room with or without ornamental objects, people felt more "carefree or playful" and "friendly or affectionate" in the room with indoor plants. A study conducted by Ramzan et al. (2007) reported that 72.5% of the people bought indoor plants for improving their indoor living environment, while 25% respondents adopted it as a hobby and the rest 2.5 % purchased it for some other reasons. Igarashi et al. (2015) opined that ornamental plants could induce feelings of comfort and relaxation in human beings.

Stress reduction

The lockdown period during COVID-19 pandemic had led to increased levels of stress, depression, anxiety and insomnia among people. With more people spending time indoors, it is imperative to provide a suitable environment both at work or at home. One of the ways of uplifting the mood and reducing the stress is to have plants nearby.

Proximity to plants and interaction with nature can have a huge impact on human attitude, behaviour and physiological responses as has been studied by several researchers. According to Ulrich et al. (1991), 'Stress reduction theory states that the presence of nature brings about evolutionary psychological responses related to safety and survival' and which in turn activates humans' parasympathetic nervous system and helps in promoting recovery from psychophysiological stress. The psychological work pressure on working class is on the rise causing stress related problems. It has been proven that keeping plants nearby or in work space and just by looking at them reduce the mental stress and causes relaxation and comfort to humans (Grinde and Patil, 2009; Piotti et al., 2021). Dijkstra et al. (2008) also stated that indoor plants had a stress relieving effect as those of nature. By simply working with plants can also help boost the production of happy hormones like dopamine and serotonin. This led to increase the efficiency of the people using the space and also for stress reduction by consideration of natural elements throughout the construction of buildings and skyscrapers, whether they are in residential complexes, workplaces, or public spaces. In a study conducted by Li and Sullivan (2016), it was noted that when students were exposed to natural views both outside or inside the classroom, it had profound influence on the psychology of students thereby helping them reduce fear and stress and improve the focusing ability. Gu et al. (2022) also opined that placing indoor plants or painting the walls green both at workplace and at home had effectively helped in reducing stress.

Health Improvement

Humans have a close association with nature and its integration into the indoor living space can effectively increase our engagement with nature which provides relaxation and comfort along with added benefits to human health. There is growing public awareness about the risks connected with inadequate indoor environments because 80–90% of individuals living in urban areas spend their time indoors. Indoor plants not only play a significant role in combating air pollution but also improves the indoor environment providing a positive psychological impact and promoting the health and comfort of the people (Han 2009; Xu et al., 2011).

Fjeld et al. (1998) noted that the improvement in health was obtained by introduction of foliage plants in to the office environment, which shows a significant reduction in neuropsychological symptoms and mucous membrane symptoms. Ali Khan et al. (2016) in their survey demonstrated that a hospital ward filled with potted plants

and flower arrangements provided a “satisfying, relaxing, comfortable, colourful, calm, and attractive” atmosphere for patients, resulting in improved vital signs in patients’ (including blood pressure, respiration rate, heart rate, and temperature), and reduced Intake of analgesic, thereby helping the patient to discharge early from hospitals. El-Tanbouly et al. (2021) in their study on role of indoor plants in context of COVID-19 pandemic concluded that use of indoor plants had proved to be cost-effective in purifying the indoor air as well improved the aesthetic which had indirectly influence over human health.

Conclusion

As discussed above, the benefits of quietly observing plants for relieving stress and adding plants can dramatically improve how people feel about a space and their mental health. According to studies on how plants affect humans, having access to plants is crucial for people to function at their best. We require plants in our daily lives since they are everywhere. They make our surroundings more civilised and sympathetic.

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