



AGRI MAGAZINE

(International E-Magazine for Agricultural Articles)

Volume: 02, Issue: 01 (January, 2025)

Available online at <http://www.agrimagazine.in>

© Agri Magazine, ISSN: 3048-8656

Indoor Plants: A Novel Source for Improving Air Quality

(*Pranjal Verma)

M.Sc. (Hort.), Department of Floriculture and Landscaping, College of Horticulture and Research Station, Sankra, Mahatma Gandhi Horticulture and Forestry University, Sankra, Patan, Durg-491111, Chhattisgarh

*Corresponding Author's email: pranjalbmkj14@gmail.com

Indoor air quality (IAQ) has become an increasingly significant concern in modern living spaces, especially with the rise of urbanization and the widespread use of synthetic materials in construction and furnishings. Poor air quality indoors can lead to various health issues, ranging from minor irritations like headaches and fatigue to chronic conditions such as asthma and allergies. One novel and natural solution to improving indoor air quality is the use of **indoor plants**, which have been found to offer multiple benefits in filtering and purifying indoor air. This review article explores the role of indoor plants in improving air quality, their mechanism of action, and the types of plants that are particularly effective.

The Impact of Poor Indoor Air Quality

Indoor air quality can be compromised by several factors, including:

- **Volatile Organic Compounds (VOCs):** These compounds are emitted from synthetic materials like paints, adhesives, and cleaning products. VOCs like **formaldehyde, benzene, and toluene** can contribute to respiratory problems and irritate the eyes, throat, and skin.
- **Particulate Matter:** Dust, pollen, and other fine particles can accumulate in indoor spaces, leading to allergies, asthma, and other respiratory issues.
- **Carbon Dioxide (CO₂):** Elevated levels of CO₂ in poorly ventilated spaces can cause drowsiness, headaches, and decreased cognitive function.
- **Mold and Mildew:** High humidity levels and poor ventilation can lead to mold growth, which releases harmful spores into the air, aggravating respiratory issues.

Improving air quality indoors is essential not only for comfort but also for the prevention of various health issues, especially as people spend more time indoors.

How Indoor Plants Improve Air Quality

Indoor plants act as natural air purifiers through various mechanisms, including:

A. Absorption of Pollutants: Plants absorb gases such as carbon dioxide (CO₂) and volatile organic compounds (VOCs) through **stomata** (small pores) on their leaves. Once absorbed, the plant metabolizes or filters these compounds.

For example:

- **Formaldehyde:** This common indoor pollutant found in furniture and insulation materials can be absorbed and detoxified by plants like the **spider plant (Chlorophytum comosum)** and **peace lily**



(*Spathiphyllum* spp.).

- **Benzene and Toluene:** These VOCs found in paints, solvents, and cleaning products can be absorbed by plants like the **bamboo palm (*Chamaedorea seifrizii*)** and **English ivy (*Hedera helix*)**.

B. Oxygen Production and Carbon Dioxide Reduction: Plants engage in **photosynthesis**, a process where they convert carbon dioxide into oxygen. During the day, plants absorb CO₂ and release oxygen, contributing to a healthier indoor environment. This can reduce the buildup of CO₂ in poorly ventilated rooms, improving overall air quality and increasing the oxygen levels available for respiration.

C. Humidity Regulation: Through **transpiration**, plants release water vapor into the air. This process can help to increase **humidity levels** in dry indoor environments, which is particularly beneficial in areas with cold winters or air-conditioned spaces. Proper humidity levels (40–60%) are essential for reducing respiratory discomfort, maintaining healthy skin, and preventing the growth of dust mites and mold.

D. Filtering Dust and Particulate Matter: Plants with large, broad leaves can capture and trap dust and particulate matter from the air, preventing these particles from circulating in the indoor environment. This can be especially useful for those with allergies and asthma. Regular care and cleaning of plants can enhance their dust-absorbing capacity.

Plants Effective in Improving Indoor Air Quality

Certain indoor plants are especially effective at purifying the air. The NASA Clean Air Study (1989) identified several plants that can help remove toxins from indoor environments. Here are some of the top plants known for their air-purifying qualities:

A. Spider Plant (*Chlorophytum comosum*)

- **Pollutants Removed:** Formaldehyde, xylene, and toluene.
- **Benefits:** Easy to grow and maintain, the spider plant is effective in absorbing formaldehyde from the air and is an excellent air purifier for small spaces.

B. Peace Lily (*Spathiphyllum* spp.)

- **Pollutants Removed:** Formaldehyde, benzene, trichloroethylene, and ammonia.
- **Benefits:** Known for its ability to remove multiple air pollutants, the peace lily also adds aesthetic value with its beautiful white blooms. It thrives in low light conditions.

C. Aloe Vera (*Aloe barbadensis miller*)

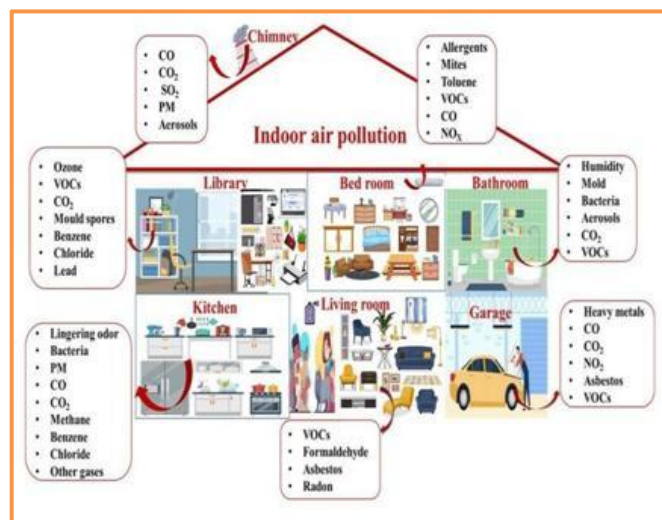
- **Pollutants Removed:** Formaldehyde and benzene.
- **Benefits:** In addition to improving air quality, aloe vera has medicinal properties and can be used topically for skin issues. It's a low-maintenance plant suitable for bright indoor spaces.

D. Snake Plant (*Sansevieria trifasciata*)

- **Pollutants Removed:** Formaldehyde, benzene, and xylene.
- **Benefits:** The snake plant is a highly efficient air purifier that continues to release oxygen at night (unlike most plants, which do so only during the day). It thrives on minimal water and light, making it ideal for busy individuals.

E. Bamboo Palm (*Chamaedorea seifrizii*)

- **Pollutants Removed:** Benzene, formaldehyde, trichloroethylene, and xylene.



- **Benefits:** Known for its air-purifying properties, the bamboo palm is also an attractive plant that thrives in low light conditions. It is often used in offices and homes to reduce indoor pollutants.

F. English Ivy (Hedera helix)

- **Pollutants Removed:** Formaldehyde, benzene, and trichloroethylene.
- **Benefits:** This vine is effective in removing airborne particles and is often placed in areas prone to high dust accumulation. It is easy to grow and maintain, and its climbing nature makes it perfect for hanging baskets.

G. Rubber Plant (Ficus elastica)

- **Pollutants Removed:** Formaldehyde.
- **Benefits:** The rubber plant’s large leaves are excellent for absorbing pollutants like formaldehyde. It thrives in indirect sunlight and is an attractive addition to living spaces.

Health Benefits of Indoor Plants

In addition to improving air quality, indoor plants offer a range of **health benefits**:

- **Mental Well-being:** Studies have shown that the presence of indoor plants can reduce **stress** and promote feelings of **calmness** and **well-being**. The act of caring for plants has also been linked to reduced anxiety and improved mood.
- **Cognitive Function:** Indoor plants have been found to enhance cognitive function and productivity, especially in workspaces. Plants can increase concentration, focus, and creativity, making them ideal for home offices or study areas.
- **Improved Respiratory Health:** By reducing the concentration of allergens, dust, and harmful pollutants in the air, indoor plants can alleviate symptoms associated with asthma, allergies, and other respiratory conditions. Increased oxygen levels can also improve lung function.

Polluting Agent	Found In	Effects on Human Health
Trichloroethylene	Printing inks, Paints, Varnishes, Adhesives, Paint Remover/Stripper, Correction Fluids	Short Term: Dizziness, Headache, Nausea, Vomiting, Eye Irritation Long Term: Liver & Kidney Damage, CNS Depression, Linked to Liver Cancer
Formaldehyde	Paper Bags, Waxed Papers, Facial Tissues, Paper Towels, Table Napkins, Plywood Paneling, Synthetic Fabrics	Short Term: Irritation of Eyes, Nose, Throat, Coughing, Skin Irritation Long Term: Increased Cancer Risk, Especially Nasopharyngeal and Leukemia
Benzene	Tobacco Smoke, Dyes, Detergents, Drugs, Plastics, Rubber, Lubricants, Gasoline	Short Term: Eye Irritation, Drowsiness, Dizziness, Headaches, Confusion Long Term: Bone Marrow Suppression, Immune System Damage, Blood Disorders (Anemia), Increased Risk of Leukemia (Carcinogenic)
Xylene	Leather, Rubber, Paints on the Wall, Tobacco Smoke, Gasoline, Adhesives	Short Term: Skin, Eye, Nose, Throat Irritation, Dizziness, Headache, Loss of Coordination Long Term: Liver & Kidney Damage, Memory Impairment, Respiratory Issues
Ammonia	Window Cleaners, Floor Waxes, Textiles, Dyes, Household Cleaners, Refrigerants	Short Term: Eye, Nose, Throat Irritation, Coughing, Wheezing, Shortness of Breath Long Term: Chronic Respiratory Conditions (Bronchitis), Exacerbation of Asthma and Lung Diseases

Additional Considerations

While indoor plants are a great natural solution for improving air quality, there are a few factors to consider:

- **Maintenance Requirements:** Some plants require regular watering, pruning, and attention. It's important to choose plants that match your lifestyle and environmental conditions (e.g., light availability, humidity).
- **Allergies:** Certain plants may cause allergic reactions in sensitive individuals. If you have plant allergies, consider low-pollen plants and avoid those that produce heavy amounts of pollen or mold.
- **Toxicity:** Some indoor plants are toxic to pets. Plants like **dieffenbachia** and **oleander** can cause poisoning if ingested by animals, so it's essential to be mindful of pet safety when choosing indoor plants.

Effectiveness of indoor plants in eliminating formaldehyde and CO₂

Plant Name	CO ₂	Formaldehyde	Reference
Areca palm	88.5%	88.16%	Bhargava <i>et al.</i> , 2020
Peace lily	83.8%	-	Hormann <i>et al.</i> , 2017
Dumb cane	90.2%	81-96%	Sarker <i>et al.</i> , 2022
Aloe vera	78%	90-95%	Sarker <i>et al.</i> , 2022
English ivy	26.7%	100%	Hashim <i>et al.</i> , 2019
Bird nest fern	60%	95%	Su <i>et al.</i> , 2015
Snake plant	81%	99.75%	Sarker <i>et al.</i> , 2022
Golden pothos	93.76%	81-96%	Tan <i>et al.</i> , 2022

Role of Indoor Plants in Reducing VOCs

- Indoor plants have been shown to be effective at **absorbing** and **removing** VOCs from indoor environments, contributing to improved air quality and reducing the adverse health impacts of VOC exposure. This process occurs through several mechanisms:

Indoor Plant Common Name	Scientific Name	Pollutants That Can Be Removed
Areca palm	<i>Chrysalidocarpus lutescens</i>	CO ₂ , Benzene, Toluene, Carbon monoxide, Formaldehyde, Xylene, Trichloroethylene
Song of India	<i>Dracaena reflexa</i>	Toluene, CO ₂ , and Volatile Organic Compounds (formaldehyde, benzene etc.)
Dumb cane	<i>Dieffenbachia seguine</i>	CO ₂ , Formaldehyde, and Toluene
Weeping fig	<i>Ficus benjamina</i>	Octane, Terpene, Formaldehyde and CO ₂
Aloe vera	<i>Aloe barbadensis miller</i>	Formaldehyde, CO ₂ and Benzene

A. Absorption and Metabolism

- Plants can absorb VOCs through **stomata** (tiny pores) in their leaves. Once absorbed, these compounds are either stored or metabolized by the plant's tissues. In some cases, the plant converts VOCs into harmless substances, helping to reduce the concentration of these chemicals in the air. For example, **formaldehyde**, a common VOC in indoor environments, can be absorbed and metabolized by plants like **peace lilies** (*Spathiphyllum* spp.), **spider plants** (*Chlorophytum comosum*), and **bamboo palms** (*Chamaedorea seifrizii*).

B. Phytoremediation

- Phytoremediation is the process by which plants absorb, transform, or detoxify pollutants, including VOCs. Plants like **English ivy (Hedera helix)** and **snake plants (Sansevieria trifasciata)** are particularly effective in removing VOCs like **benzene, toluene, and xylene** from the air. These plants store the chemicals in their tissues or convert them into less harmful forms, making them an efficient natural air purifier.

C. Increased Oxygen Production

- In addition to removing VOCs, plants help improve air quality by increasing **oxygen levels** in the environment through photosynthesis. This process is especially beneficial in environments with high concentrations of VOCs, as oxygen supports the body's natural detoxification processes and helps mitigate the negative effects of air pollutants.

COMMON NAME	BOTANICAL NAME
Areca Palm	<i>Dypsis lutescens</i>
Lady Palm	<i>Rhapis excelsa</i>
Bamboo Palm	<i>Chamaedorea seifrizii</i>
Rubber Plant	<i>Ficus elastica</i>
Dracaena Janet Craig	<i>Dracaena deremensis</i>
English Ivy	<i>Hedera helix</i>
Dwarf Date Palm	<i>Phoenix roebelenii</i>
Ficus Alii	<i>Ficus maclellandii</i>
Boston Fern	<i>Nephrolepis exaltata</i>
Kimberly Queen Fern	<i>Nephrolepis obliterated</i>
Spider Plant	<i>Chlorophytum comosum</i>
Peace Lily	<i>Spathiphyllum</i>
Chinese Evergreen	<i>Aglaonema</i>
Gerbera Daisy	<i>Gerbera jamesonii</i>
Pot Mum	<i>Chrysanthemum morifolium</i>
Cornstalk Dracaena	<i>Dracaena fragrans</i>
Weeping Fig	<i>Ficus benjamina</i>

Indoor Plants and Their Placement According to Their Role

1. Air Purification and VOC Removal

Optimal Placement:

- **Living Rooms and Offices:** High-traffic areas where VOCs from furniture, paint, and electronic devices may accumulate. Place larger plants like bamboo palm or peace lily here.
- **Kitchens:** Kitchens are often exposed to VOCs from cooking, cleaning products, and appliances. Spider plants and snake plants are well-suited for this environment and can be placed on countertops or windowsills.

2. Mental Well-being and Stress Reduction

Optimal Placement:

- **Bedrooms:** Place lavender or jasmine near the bedside or on a nightstand to create a calming atmosphere conducive to restful sleep.
- **Workspaces:** Snake plants, aloe vera, or peace lilies can help increase focus and reduce stress. These plants should be placed on desks or near windows to ensure they thrive in indirect light.

3. Humidity Regulation

Optimal Placement:

- **Bathrooms:** Since bathrooms are naturally more humid, plants like Boston fern and English ivy thrive in this environment. Place them in spots with indirect light, such as on bathroom shelves or hanging planters.

- **Living Rooms and Offices:** In dry rooms, an Areca palm or peace lily can help regulate humidity. These plants can be placed near heating sources or in corners that receive moderate light.

Conclusion

Indoor plants are not only aesthetically pleasing but also serve as an effective and natural solution for improving air quality in modern homes and offices. Through their ability to absorb pollutants, release oxygen, regulate humidity, and trap dust particles, plants play a crucial role in creating healthier indoor environments. Whether you choose **low-maintenance succulents, lush foliage plants, or flowering species**, incorporating indoor plants into your space can significantly contribute to better air quality and overall well-being. In a world where air pollution is a growing concern, indoor plants offer a simple, sustainable, and cost-effective way to combat air quality challenges while enhancing the aesthetic and psychological benefits of indoor spaces.

References

1. Bhargava, B., Malhotra, S., Chandel, A., Rakwal, A., Kashwap, R. R., & Kumar, Mitigation of indoor air pollutants using areca palm potted plants in real-life settings. *Environmental Science and Pollution Research*, 28(7), 8898–8906.
2. Dominici, L., Fleck, R., Gill, R. L., Pettit, T. J., Irga, P. J., Comino, E., & Torpy, F. Analysis of lighting conditions of indoor living walls: Effects on CO₂ removal. *Journal of Building Engineering*, 44, 102961.
3. Efficiency of snake plants absorb carbon dioxide in offices. (2015). International Conference on Chemical, Metallurgy and Material Science Engineering (CMMSE-2015) August 10-11, 2015 Pattaya, Thailand.
4. Hashim, N. H., Teh, E. J., & Rosli, M. A. (2019). A Dynamic Botanical Air Purifier (DBAP) with activated carbon root-bed for reducing indoor carbon dioxide levels. *IOP Conference Series: Earth and Environmental Science*, 373(1): 012022.
5. Kavathekar, A., & Bantanur, Study of the influence of indoor plants as an indicator of biophilic design on CO₂ concentrations in a classroom of Higher Education Institute. *Journal of Sustainable Architecture and Civil Engineering*, 31(2), 96–108.
6. Lin, M.-W., Chen, L.-Y., & Chuah, Y.-K. (2017). Investigation of a potted plant (*hedera helix*) with photoregulation to remove volatile formaldehyde for improving indoor air quality. *Aerosol and Air Quality Research*, 17(10), 2543–2554.
7. Moya, T. A., van den Dobbelen, A., Ottel , M., & Bluysen, P. M. (2018). A review of Green Systems within the indoor environment. *Indoor and Built Environment*, 28(3), 298–309.
8. Shishegaran, A., Shishegaran, A., Najari, M., Ghotbi, A., & Boushehri, A. N. (2020). Effect of plants on an environment with high carbon dioxide concentration. *Cleaner Engineering and Technology*, 1, 100002.
9. Su, Y.-M., & Lin, C.-H. Removal of indoor carbon dioxide and formaldehyde using green walls by bird nest fern. *The Horticulture Journal*, 84(1): 69–76.
10. Taemthong, W., & Cheycharoen, N. Green walls can improve indoor air quality in the classroom. *Proceedings of International Structural Engineering and Construction*, 9(1).