

BENEFITS AND POSITIVE EFFECTS OF SOME HOUSEPLANTS ON INDOOR AIR QUALITY

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Abstract. *In a time when industrialization and urbanization rates reach even higher, and lack of green spaces is becoming more acute, it appears the issue of air quality both inside and outside. This problem was approached by researchers at NASA in the late 80s for the first time. Since then, worldwide researchers have tried to discover the beneficial effects that plants have on quality of life and how they can be used for maximum effect. Following these studies it has been produced lists of plants that have the best ability to refresh the air in the room and to absorb the largest amount of toxins. These plants, called generically "purifying" are used because of their therapeutic qualities and also for their decorative attributes, to complete the decoration of offices, classrooms of the school or hospital wards.*

Keywords: absorption, air quality, purifying plants, toxins

INTRODUCTION

The plants in our home are the best companion in the sultry summer days, especially if we sit between four walls from 15 to 20 hours at home and at work.

It is known that by our lungs are passing every day ten thousand liters of air. And the air is not always pure (<http://www.medicina-naturista.ro/plante/plantele-sanatate-si-articol-decorativ-in-viata-noastra.html>).

Indoor air quality (IAQ) is a term which refers to the air quality within and around buildings and structures, especially as it relates to be health and comfort for building occupants. IAQ can be affected by gases (including carbon monoxide, radon, and volatile organic compounds), particulates, microbial contaminants (mould, bacteria) or any mass or energy stressor that can induce adverse health conditions ([http://en.wikipedia.org/wiki/Indoor air quality](http://en.wikipedia.org/wiki/Indoor_air_quality)).

Most people spend a majority of their time indoors in increasingly well-sealed buildings surrounded by paints and other synthetic materials which off-gas noxious chemicals. These conditions are related to increasing incidences of asthma, allergies and cancer. Indeed, indoor air quality can be much more polluted than outdoor air, up to tenfold (<http://www.mnn.com/health/healthy-spaces/stories/top-10-air-purifying-houseplants>).

For a better understanding of the damage produced by the objects used in the majority of the homes, the researchers studied the influence of the chemicals on humans.

Formaldehyde, benzene, ammonia, trichlorethylene are involved in the development of respiratory disorders, skin rashes, headaches, etc. Regular ventilation reduces concentration; however it is hard to eliminate the many products are used at home (<http://forum.softpedia.com/lofiversion/index.php/t441320.html>). Formaldehyde is found in virtually all indoor environments (<http://www.humeseeds.com/purify.htm>). It is used in consumer paper products, including grocery bags, waxed papers, facial tissues and paper towels. Other sources of formaldehyde include heating and cooking fuels like natural gas,

kerosene, and cigarette smoke. Formaldehyde irritates the mucous membranes of the eyes, nose and throat and the most serious of the diseases attributed to formaldehyde exposure was asthma (<http://www.zone10.com/nasa-study-house-plants-clean-air.html>).

Trichloroethylene is a commercial product that has a wide variety of industrial uses. It is used in some printing inks, paints, lacquers, varnishes and adhesives (<http://www.humeseeds.com/purify.htm>). Over 90% of the trichloroethylene produced is used in the metal degreasing and dry cleaning industries.

Benzene is a commonly used solvent in such items as gasoline, inks, oils, paint, plastic and rubber. Furthermore, it is used in the manufacture of detergents, explosives, pharmaceuticals and dyes. Benzene has been long known to irritate the skin and eyes. Acute inhalation of high levels of benzene has been reported to cause dizziness, weakness, euphoria, headache, nausea, blurred vision, respiratory diseases, tremors, irregular heartbeat, liver and kidney damage, paralysis and unconsciousness (<http://www.zone10.com/nasa-study-house-plants-clean-air.htm>).

Besides the rich contribution they have in maintaining clean air, indoor plants can reduce headaches, stress, symptoms related to colds, heart and circulation (http://www.gradinamea.ro/Plante_de_interior_care_purifica_aerul_7204_539_1.html).

Plants also increase the humidity from 5 to 10%, and this reduces the degree of discomfort associated with dry air inside the homes and offices.

Numerous studies in Norway, Netherlands and United States have shown that the simple presence of plants in companies, universities, schools and hospitals improve concentration, effectiveness and reduces absenteeism. They reduce fatigue, stress, stimulate creativity and aid in recovery after surgery (<http://www.medicina-naturista.ro/plante/plantele-sanatate-si-articol-decorativ-in-viata-noastra.html>).

MATERIAL AND METHOD

In the late 1980s, a study by NASA and the Associated Landscape Contractors of America (ALCA) resulted in excellent news for homeowners and office workers everywhere. The study concluded that common houseplants such as bamboo palms and spider plants not only make indoor spaces more attractive, they also help to purify the air! The study was conducted by Dr. B.C. Wolverton, Anne Johnson, and Keith Bounds in 1989. While it was originally intended to find ways to purify the air for extended stays in orbiting space stations, the study proved to have implications on Earth as well (<http://www.humeseeds.com/purify.htm>).

The studies were made in a clear, cubical chamber, measuring 73.7 cm on each side (Wolverton, 1988). All plants were tested in a sealed experimental chamber during a 24 hour exposure period (<http://www.humeseeds.com/purify.htm>).

While NASA found that some of the plants were better than others for absorbing these common pollutants, all of the plants had properties that were useful in improving overall indoor air quality (<http://www.humeseeds.com/purify.htm>).

RESULTS AND DISCUSSION

Plants are known to absorb and metabolize gaseous formaldehyde. Formaldehyde enters plant leaves through stomata and the cuticle, and is more readily absorbed by the abaxial surface and by younger leaves (Kwang, 2008).

The main advantage of plants is their power to sweat, releasing toxins and fine droplets that capture toxins and reduced by 20% the concentration of dust and automatically the concentration of allergens, germs and bacteria by 50-60% in a room. (<http://www.medicina-naturista.ro/plante/plantele-sanatate-si-articol-decorativ-in-viata-noastra.html>).

Microbial development in buildings can be found in places where humidity accumulates including defective heating and air conditioning systems, garbage disposal, bathrooms, water leaks etc. and has been shown to provoke toxic and allergenic responses (Benoit, 2008).

The research done by NASA in the '80s have shown that many house plants purify the air and can remove up to 87% of the amount of toxins in the air. All plants were tested in a sealed experimental chamber during a 24 hour exposure period (<http://www.eva.ro/casa-si-familie/plante/plantele-care-iti-purifica-aerul-din-locuinta-articol-31280.htm>).

It is estimated, as a result of this research, that 15 to 20 of these test houseplants can purify the interior of a typical house of 1,800 square feet (<http://www.humeseeds.com/purify.htm>).

According to NASA, would be the recommended a distribution of 15 to 18 mature plants in a house with an area of about 160 m², to keep the level of emissions on the U.S. environmental standards (<http://forum.softpedia.com/lofiversion/index.php/t441320.html>).

It was composed a list of plants known to be air purifiers, of which the most common are specified below.

Although is not occupying a higher position on the scale conducted by NASA, as an air purifier plant *Phoenix roebelinii* is still a very effective and elegant, that decreases the concentration of chemical toxins floating in air. The score awarded by NASA in terms of air purification coefficient is 7.8.

The *Ficus alii* (or *Ficus macleilandii*) is not as potent in removing toxins like, say, *F. elastica*, but is still a plus in any home or office, where fresh air is poor. Score awarded by NASA in terms of air purification coefficient is 7.7.

Nephrolepis exaltata is the most popular herb that purifies the indoor air. Score awarded by NASA in terms of air purification coefficient is 7.5.

Spathiphyllum sp is an important plant on NASA's top, made of breathable air purifying plants. *Spathiphyllum* removes toxins from the air inside spaces and it represents a natural air purifier that will remain on the job 24/7. Score awarded by NASA in terms of air purification coefficient is 7.5 (Fig. 2) (<http://www.clujconstruct.ro/articole-si-noutati/articole-de-specialitate/plantele-de-interior-si-purificarea-aerului.html>).

Hedera - is excellent to remove benzene, carbon monoxide, formaldehyde, trichloroe, thylene from the air.

Philodendron - remove formaldehyde, the most common toxin, found in indoor environments where many cleaning products are used or where gas stoves are present.

Chlorophytum - is good for absorbing toxic gases that accumulate in buildings with poor ventilation. The plant, also known as spider plant, is remarkably effective: in a few days, absorbs 90% of formaldehyde and carbon monoxide.

Aspidistra - is a flat green plant with large leaves, that is removing toxins like tobacco or gas (<http://www.medicina-naturista.ro/plante/plantele-sanatate-si-articol-decorativ-in-viata-noastra.html>).

Chrysanthemum - absorbed benzene produced by cigarette smoke, toxins emitted by printers, photocopiers, adhesives, paints, varnishes and stains (Fig. 2) (http://www.gradinamea.ro/Plante_de_interior_care_purifica_aerul_7204_539_1.html).

Anthurium removes the ammonia that it's accumulating in the room, especially in the kitchen (<http://www.eva.ro/casa-si-familie/plante/plantele-care-iti-purifica-aerul-din-locuinta-articol-31280.html>).

Chamaedorea eliminate formaldehyde, benzene, carbon monoxide, xylene, chloroform, and more others (Fig. 1).

Epipremnum aureum - Virtually indestructible, golden pothos is considered one of the most effective indoor purifiers of the plant world because is eliminating formaldehyde, xylene, toluene, benzene, carbon monoxide, and more (<http://www.healthline.com/health-slideshow/air-purifying-plants#6>).

Gerbera, *Dracaena marginata*, *Spathiphyllum*, *Dracaena 'Janet Craig'* and *Chamaedorea*, in this order were the five most effective plants in removing trichloroethylene concentrations from the air.

Gerbera, *Chrysanthemum* (Fig. 2.), *Spathiphyllum*, *Chamaedorea*, *Dracaena warneckeii*, *Hedera helix* and *Sansevieria trifasciata* are the seven top houseplants for removing benzene concentrations in the air.

Chamaedorea, *Dracaena 'Janet Craig'*, *Sansevieria* (Fig. 1.), *Dracaena marginata*, *Spathiphyllum*, *Chlorophytum*, are recommended for removing concentrations of formaldehyde in the air (<http://www.humeseeds.com/purify.htm>).



Fig. 1. *Chamaedorea* (1) and *Sansevieria* (2)



Fig. 2. *Spathiphyllum* (5) and *Chrysanthemum* (6)

(<http://www.liveinthenow.com/article/6-house-plants-that-improve-youre-air-quality-according-to-nasa>)

The aerial plant parts and the root zone of potted *F. japonica* and *F. benamina* plants effectively removed gaseous formaldehyde from the air. The aerial plant parts of the plants readily metabolized formaldehyde during the day; the root zone was a major contributor to the removal, especially during the night when the stomata were closed (Kwang, 2008).

Also ideal for offices or salons are cacti that reduce static electricity that attracts dust, it limits the harmful effects of electromagnetic waves of TVs screens and computers (<http://www.medicina-naturista.ro/plante/plantele-sanatate-si-articol-decorativ-in-viata-noastra.html>).

CONCLUSIONS

As can be seen, plants are one of the best methods to improve indoor air quality, due to their capacity of absorbing toxins and carbon dioxide and to regulate the humidity level. In addition, researchers have proved that houseplants influence the human activity by reducing stress and stimulating the creative activity.

These plants are wonderful specimens to have in the house and are very popular for good reason. If their toxic aspect is not a problem many of these plants are very beneficial to have in your home. These beautiful house plants provide everything from expansive foliage that can be enjoyed year round, to beautiful sprays of flowers, to cleaning the air we breathe. Thanks to research by NASA we have a list of common house plants that are very efficient at purifying air (<http://www.blankees.com/house/plants/>).

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