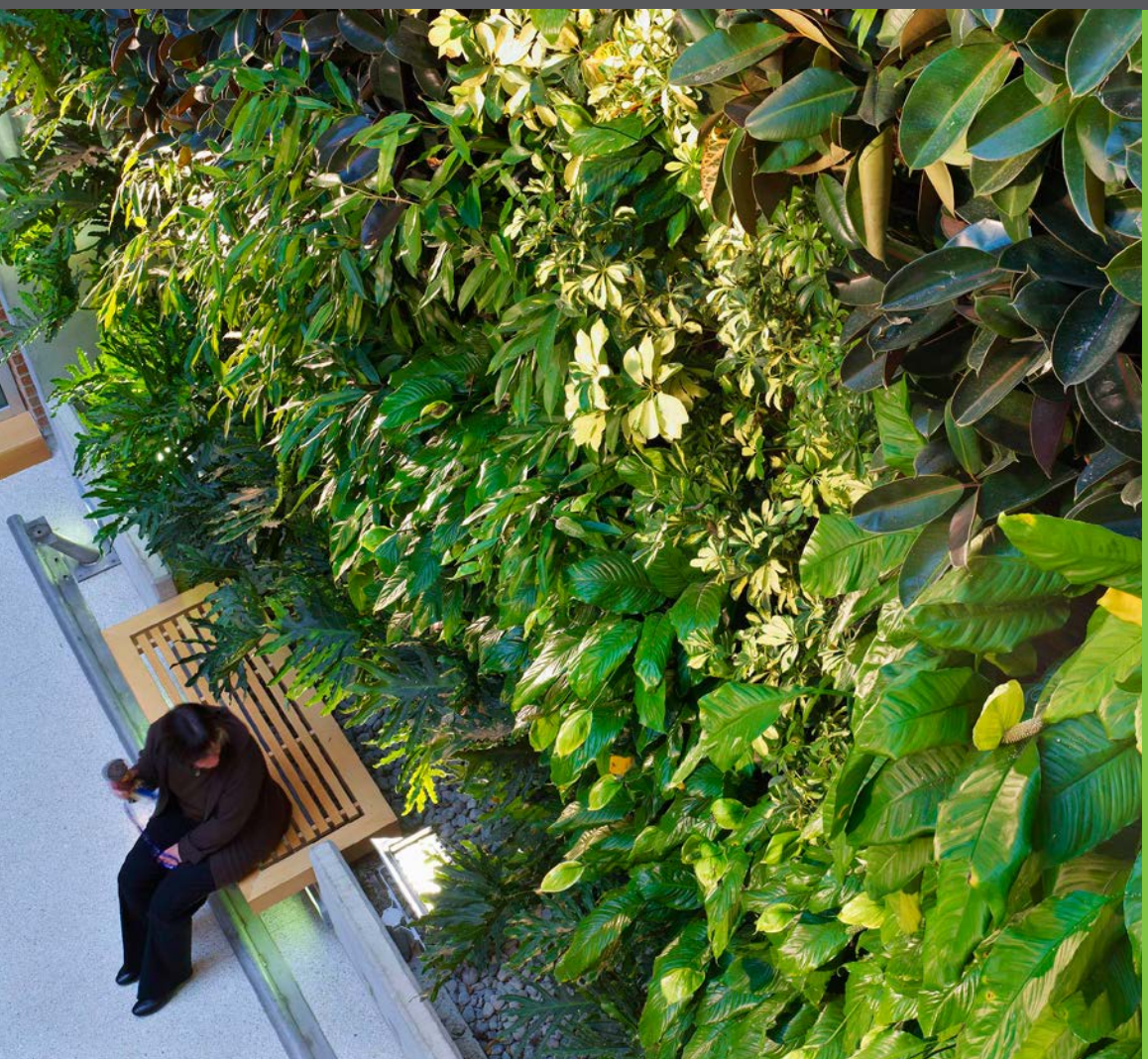
The USA EPA Does Not Believe Indoor Plants Have a Real Impact on IAQ



A Technical Note by Dr. Alan Darlington

NEDLAW LIVING WALLS

Rejuvenate with science.™

Background

Very original research, done in the early 1980's, by Dr. Bill Wolverton from NASA, suggested indoor plants can remove chemicals from indoor air (Wolverton et al. 1984, 1989).

In these study, the rate of disappearance of formaldehyde from a Plexiglas chamber was measured in the absence or presence of spider plants. The chemical disappeared faster in the presence of the spider plants. QED spider plants remove formaldehyde.

The Issue

The basic concept of potted plants cleaning indoor air has not been widely accepted by others outside the interior plant industry.

The USA EPA does not believe indoor plants have a real impact on indoor air quality (http://www.epa.gov/iaq/pubs/hpguide.html#faq7). The basic concept of potted plants cleaning indoor air has not been widely accepted by others outside the interior plant industry. Examples of the sort of skepticism towards the idea can be found in the review by Dr. Hal Levin (Levin 1992, Girman et al., 2009) and Dixon and Llewellyn (2013).

Barriers to Potted Plants Maintaining Indoor Air Quality

The criticism of the ability of plants either in pots on the ground or on the wall to remove pollutants from indoor air can be summarized as follows;

Chamber experiment not a good model for 'Real' World

The very rapid air circulation within the chamber (large fan moving the air very quickly) make the application of the findings to the real world, difficult. Efforts to replicate these experiments in the real world have met with poor success (Dingle *et al*., 2000).

Foliage is not critical

Later studies found the removal of the plants shoots or at least the lower leaves, increased the rate of removal of the chemicals from the air in the chambers (Godish and Guindon, 1989; Wolverton et al., 1989). The faster rate of removal by pots without the leaves suggested the plant leaves were not involved in the removal of the chemicals from the air.

If anything, the leaves were more likely acting as a barrier between the air and the soil, slowing the movement between the two. Further, plants tend not to 'eat' organic materials from the air: they lack the required biochemical pathways. They may have small capabilities (Guieysse et al. 2008; Yang et al. 2009,) but not enough to have a real impact on air quality.

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Microbes that are capable of breaking down chemical pollutants such as those found in indoor air are routinely found in soil (Pilon-Smits 2005). This is the basis of the science of biofiltration (Devinny et al., 1999): an industrial process where a contaminated air or water stream is drawn through a biologically active zone where beneficial microbes can degrade the pollutant.

Green plants encourage the growth of these beneficial microbes by supplying them with nutrients and vitamins. This is the basis of phytoremediation, a method of recovering polluted soils using a combination of plants and microbes (Pilon-Smits 2005). But, just because these *can happen* in a pot doesn't mean they are happening fast enough to have a real impact.

The 'pot' prevents the microbes from being exposed to the dirty air

There are two criteria that must be met before a contaminant can be broken down by microbes; first there must be microbes present that are capable of breaking the contaminant down. Second, the microbe must have access to the contaminant. Microbes capable of breakdown many indoor air contaminants are routinely found in soil (Wood *et al*., 2006).

And green plants increase their numbers which meets the first criteria. But, in a typical potted plant whether on the ground or wall, these beneficial microbes are growing in the center of a pot, surrounded by dense soil, encased in plastic or ceramic container. Only a very small proportion of the soil in the top of pot is directly exposed to the air. And more often than not that tends to be covered with a barrier of plant leaves.

Even if porous 'pots' are used such as terra cotta or fabric, this still represents a sizeable resistance to air flow. If the contaminants are able to diffuse (a very slow process) to the soil, it must then diffuse through many centimeters of soil to get to the microbes (an extremely slow process) (see Godish and Guindon, 1989 for more details).

The potted plant may be able to breakdown air borne contaminants but the microbes growing in the soil are exposed to such a small volume of air, its impact is, inconsequential in the real world (Godish and Guindon, 1989; Godish, 1989; Levin, 1992; Girman et al., 2009).

NEDLAW Living wall biofilters have a true, substantiated impact on air quality.

The Nedlaw Living Wall Biofilter Overcomes These Barriers

The original work by Wolverton was truly revolutionary in its perspective. It was ground breaking. Prior to his work, few had thought of the potential of biological systems to remove 'man-made' pollutants.

The Nedlaw system builds on the work of Wolverton and other pioneers in the area of 'bio-remediation' to yield a system engineered to overcome the barriers and maximize the efficiency of the system. NEDLAW Living wall biofilters have a true, substantiated impact on air quality (Darlington *et al*., 1998, 2001).

With the NEDLAW system:

- Air is actively forced through a very porous, very thin media in which naturally occurring beneficial microbes come in close contact with the contaminants in the air. Allowing the microbes easy access to the contaminants
- The media has a very low resistant to air flow. This allows very large volumes of air to be treated, very quickly and therefore the system can have a substantial impact on indoor air quality.
- Plants are grown on the very porous rooting media. The presence of plants is a source of good healthy microbes in the system. The plants facilitates the ability of the beneficial microbes to breakdown harmful chemicals in the air.
- The system has been proven to remove substantial amount of indoor pollutants under real world conditions.

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