IMPROVING INDOOR AIR QUALITY WITH LIVING WALLS

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PROBLEM

Modern construction practices usually involve many building materials that are almost all produced and finished using industrial solvents. These materials, along with interior finish such as lacquers, paints, adhesives, inks, and cleaners, all contribute to off gassing of volatile organic compounds (VOCs). These VOCs not only smell unpleasant, but also pose health risks as some are even carcinogenic such as benzene, formaldehyde, and trichloroethylene. HVAC systems are needed to cycle fresh air in order not to exceed toxicity levels in indoor environments.

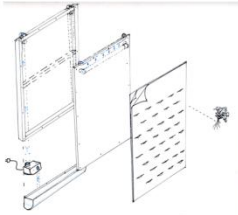
APPROACH

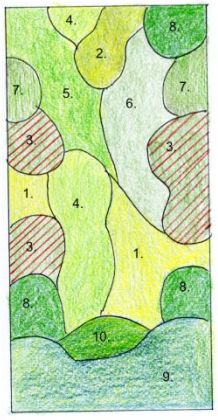
Phytoremediation denotes the process of using plants to treat environmental problems and mitigate pollution concentrations in soil, water, or air. During the space race, NASA conducted many experiments to determine species that could sustain a human in a contained air cell. The report lists many that are common houseplants today, such as the Spider plant (*Chlorophytum comossum*), the Golden pothos (*Epipremnum aureum*), and the Peace lily (*Spathiphyllum* "Mauna Loa") pictured above. The Peace lily is exceptional, and can filter out ammonia, benzene, formaldehyde, toluene, trichloroethylene, and xylene. The aim is to use these specific plants to biologically filter VOCs in an indoor environment most efficiently, without requiring much human intervention, and within a limited area.

LIVING WALL

An interior living wall with phytoremediation species is proposed in order to effectively biofilter the indoor air and also use space efficiently.

The concept of growing plants on a vertical surface is not new. However, with new technological advances such as hydroponics and expanded PVC, this concept has recently allowed designers to create lush vertical landscapes. Patrick Blanc (above) is considered the foremost expert in the field and uses a thin system of expanded PVC panel with 3 layers of capillary felt and plantings inserted into slits cut in the outer layer.

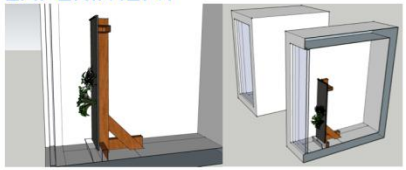




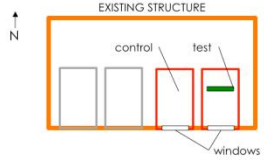
PLANTING DIAGRAM

1. Chlorophytum comossum
2. Dieffenbachia amoena
3. Dracaena marginata
4. Dracaena warneckii
5. Epipremnum aureum
6. Philodendron micans
7. Schefflera arboricola
8. Spathiphyllum "Mauna Loa"
9. Nephrolepsis exaltata
10. Nephrolepsis obliterata

EXPERIMENT



An experiment to test whether these specially adapted living walls con significantly remove VOCs, consists of two sealed containers (recycled from a previous SUST capstone), both outfitted with windows and the necessary sensors to detect and record temperature, humidity, CO, CO2, and certain VOCs. One is left as a control against the second, which contains the living wall.



HYPOTHESIZED RESULTS

Once the containers are sealed, the sensors will record data points for each measurement every 30 minutes for the duration of the experiment of 48 hours. Due to the evaporation and transpiration from the living wall, the temperature should be lower and the humidity higher in the living wall container. The concentrations of VOCs should steadily decrease and the difference in rates of decrease will indicate how much is absorbed by the plants.

SUSTAINABILITY

Built Systems

Applications of living walls for indoor phytoremediation are not only aesthetically pleasing and beneficial to the building occupants, but also help regulate the temperature and humidity, which will lessen the reliance on HVAC systems.

Natural Systems

Even though these living wall systems are purely artificial, many levels of biological production other than the plants are employed such as mosses, fungi, algae, and a plethora of microorganisms.

Social Systems

With appropriate maintenance plans, indoor living walls, will continue to provide benefits indefinitely. These benefits will enrich the atmosphere with more oxygen and less toxins, enhance employee moods, and hopefully improve employee productivity. Also, with the presence of nature may have an added educational aspect.

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