
Development of hydroculture plants for the improvement of indoor air quality



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Student Declaration

I certify that this thesis has not already been submitted for any other degree and is not being submitted as part of the candidature for any other degree.

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Abstract

Tissue-cultured plants (*Syngonium podophyllum*) planted into conventional potting mix and hydroculture were investigated for their capacities to bring about reductions of the two major types of indoor air pollution; volatile organic compounds (VOCs) and CO₂.

The results confirm that, with a moderate increase in indoor light intensity, the species used could be developed and used to remove significant amounts of indoor CO₂. The results also indicate that hydroculture as a growth medium makes for greater efficacy of CO₂ removal than potting mix. Furthermore, the VOC removing potential of hydroculture plants was demonstrated. Whilst the rate of VOC removal was somewhat slower than plants grown in traditional potting mix, the simultaneous capacity of the system for effective CO₂ removal is evidence that hydroculture is a more effective system for functional indoor plants than the potting mix systems that are used now.

An examination was also made of the possibility of bioaugmentation with both rhizosphere bacteria and arbuscular mycorrhizal fungi to improve the performance of the hydroculture plants to improve growth and remove more VOCs, while maintaining a lower microbial load than potting mix, so as to reduce soil CO₂ emissions, however, the efforts trialled here in this species were unsuccessful.

The effect of benzene on the community level physiological profiles of rhizospheric bacteria of hydroculture plants was assessed. Whilst the bacterial community present in hydroculture was reduced in diversity compared to potting mix, the species present encompassed at least some of those involved with VOC removal, thus indicating that hydroculture plants should still be an effective means of reducing indoor VOC concentrations.

A qualitative screen for pathogenic fungal spores from plants grown both in hydroculture and potting mix showed the nutrient solution and supporting media did not harbour any pathogenic fungi and are thus unlikely to pose a major health risk.

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List of Abbreviations

ANOSIM	Analysis of Similarity
ANOVA	Analysis of Variation
AMF	Arbuscular Mycorrhizal Fungi
CFU	Colony Forming Units
CO ₂	Carbon Dioxide
CO	Carbon Monoxide
CLPP	Community Level Physiological Profiles
GC	Gas Chromatography
HP	Hypersensitivity Pneumonitis
HVAC	Heating, Ventilation and Air Conditioning
IAQ	Indoor Air Quality
LCP	Light Compensation Point
LRC	Light Response Curve
NO _x	Oxides of Nitrogen
OD	Optical Density
PAH	Polycyclic aromatic Hydrocarbons
PAR	Photosynthetically Active Radiation
PCA	Principal Components Analysis
ppmv	Parts Per Million by volume
RBC	Rose Bengal Chloramphenicol Agar
SBS	Sick Building Syndrome

SO _x	Oxides of Sulfur
SDX	Sabouraud Dextrose Agar
TSB	Tryptic Soy Broth
TVOC	Total Volatile Organic Compound
UAP	Urban Air Pollution
UTS	University of Technology, Sydney
VOC	Volatile Organic Compound
± SE	Standard Error of the Mean

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