STUDENT RESEARCH

Fuelling phytoremediation: gasoline degradation by green wall system-a case study

SYNOPSIS

Gasoline vapour is one of the key emission sources of complex mixtures of harmful volatile organic compounds (VOCs), several studies have demonstrated that indoor occupants within areas surrounding gasoline stations or with residentially attached garages are exposed to far more harmful concentrations of VOCs on average, with many of these being known class 1 and 2 Benzene, toluene, ethylbenzene and xylene carcinogens.

Here we assess the potential of a commercial small passive green wall system, commercially named the 'LivePicture Go' from Ambius P/L, Australia, to drawdown VOCs that comprise gasoline vapour, including total VOC (TVOC) removal and specific removal of individual speciated VOCs over time
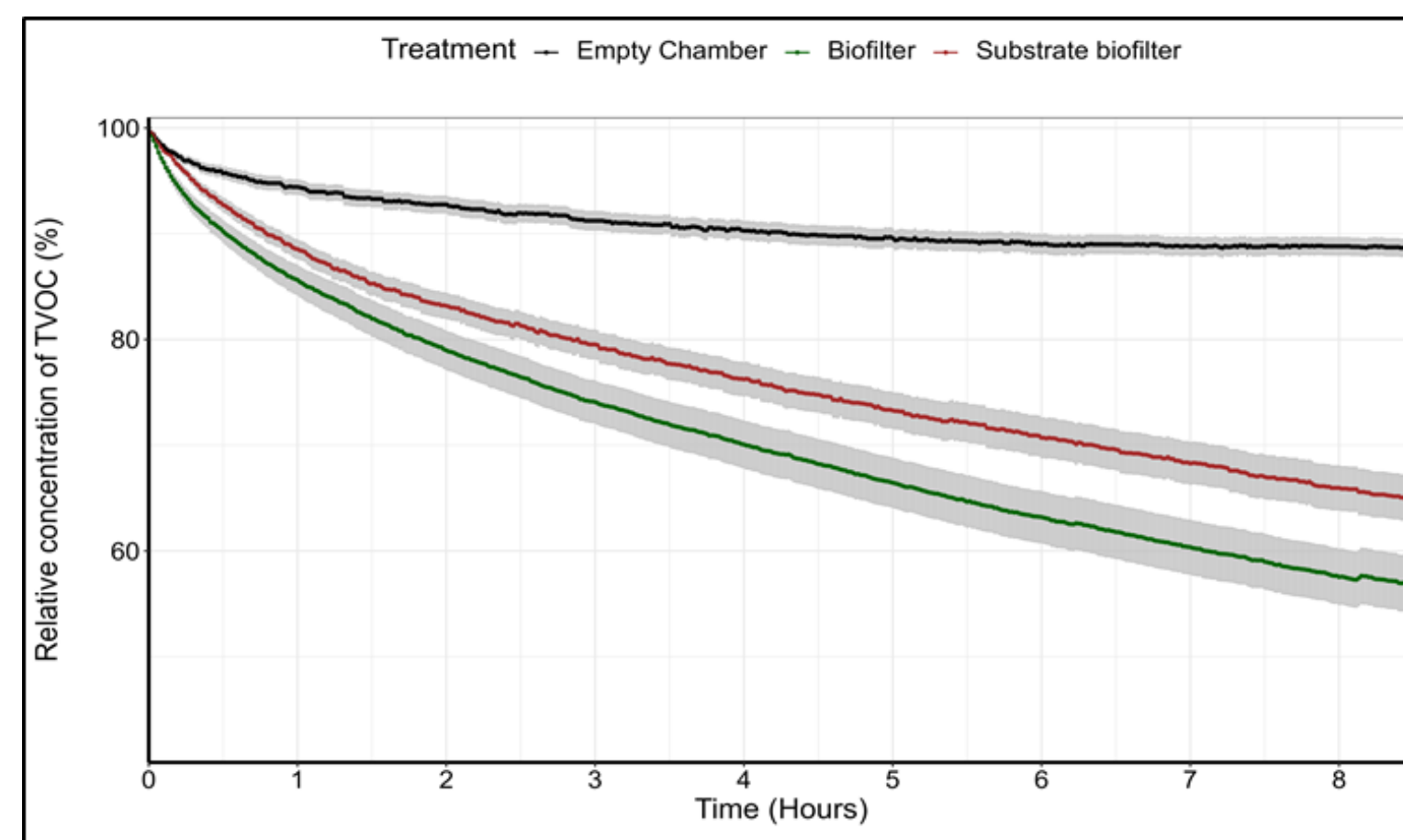

Figure 1. Experimental green wall system. Containing:
Epipremnum aureum
Syngonium podophyllum
Chlorophytum comosum

Figure 2. Relative TVOC drawdown for each treatment over 8 h. Error bands represent the SEM.

The TVOC decay rates for the biofilter and substrate biofilter treatments were **11 ± 0.97 and 8.20 ± 1.42 ppb.h−1**, respectively.

These two treatments removed:

42.47 ± 2.57 and 34.04 ± 2.05% of injected TVOCs, respectively, over 8 h. Both significantly outperforming the control.

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OBJECTIVE

- Quantify the removal potential of a small passive green wall system for gasoline vapour

- Record the degradation for speciated petrochemical-derived VOCs

METHODOLOGY

Total VOC exposure concentration were 232 ± 35.70 ppb
Speciation was performed via gas chromatography–mass spectrometry (GC-MS; s were exposed to a total VOC concentration of ISQ™ 7610 Single Quadrupole GC-MS, Thermo Fisher, USA)

ESTIMATED RESEARCH LENGTH

Research was conducted over the year of 2023

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Figure 3.

Over an 8-h exposure the biofilter removed:
80.82 ± 0.01% of benzene-1-ethyl-2-methyl (p = 0.001)
79.68 ± 0.19% of ethylbenzene (p = 0.003)
82.29 ± 0.14% of σ-xylene (p = 0.035)
Considerable toluene reductions
(72.23 ± 2.82%)

Results

GC-MS speciation identified 21 unique gasoline VOCS (pVOCs)

Three pVOCs :

Eicosane
Pentadecane
1,2,3-trimethyl-benzene

Removed by the green walls to below the detection limit of the GC-MS within the first hour.
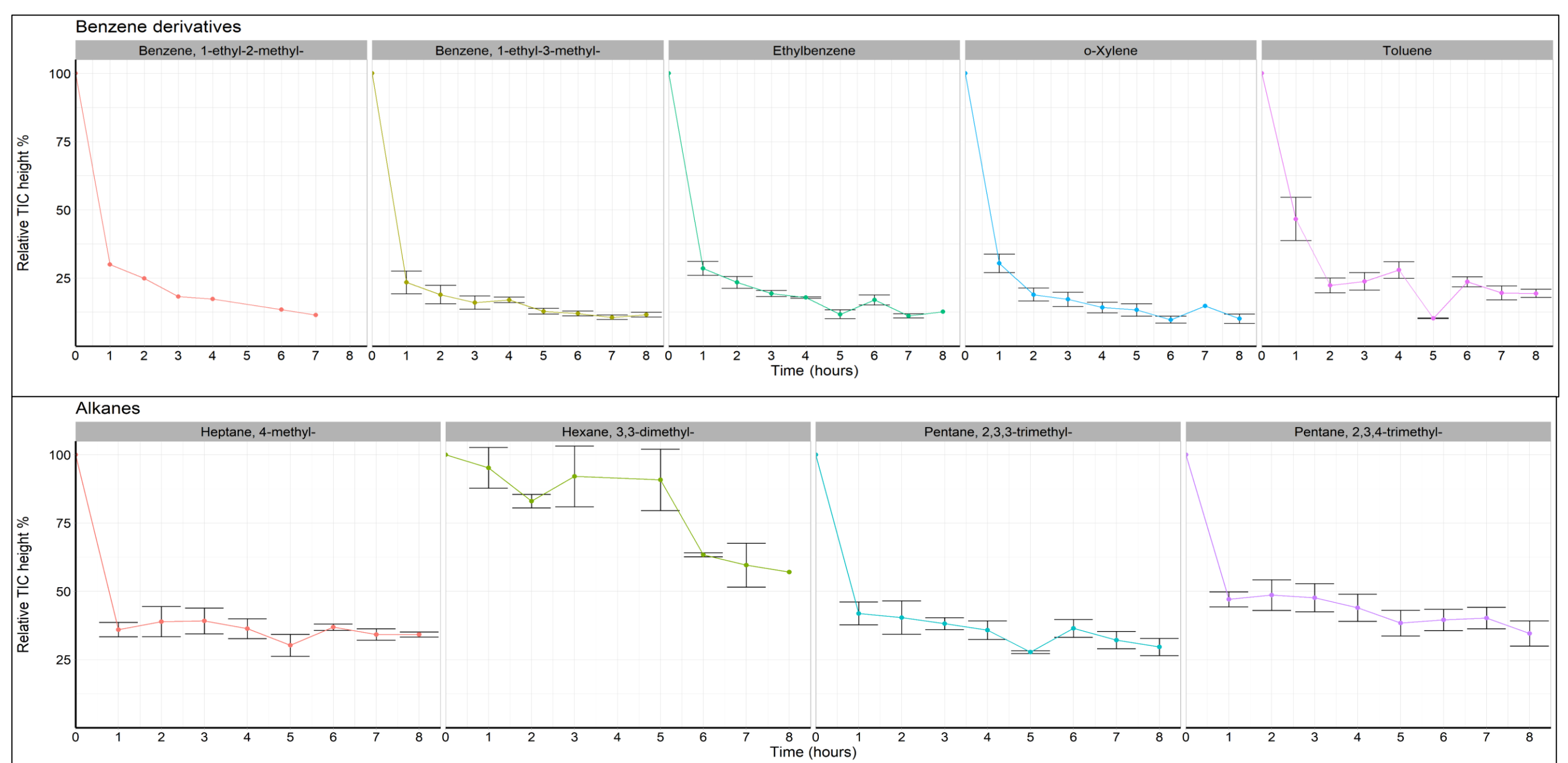

Figure 4. Relative removal curves for benzene derivatives and alkanes. Error bars represent the SEM