

## EDUCATION SERIES RESEARCH REVIEWS

The **greenscreen® Education Series - Research Reviews** is a series of briefs composed as summaries to help educate our design partners about important issues supported by international research efforts. Document titles and authors are listed, and we encourage you to read original transcripts for a complete understanding of methodologies, intent, and the original research summaries.

Also available: The **greenscreen® Education Series - Case Studies** is a series reviewing specific **greenscreen®** installations for a variety of climate zones, building types, site and landscape conditions.

### ***Vegetated Facades and Air Quality: plant covered walls help filter polluted air and promote healthy exteriors and interiors***

**Original Study Title:** “Practical and Theoretical Investigation of the Influence of Facade Greening on the Distribution of Heavy Metals in Urban Streets”

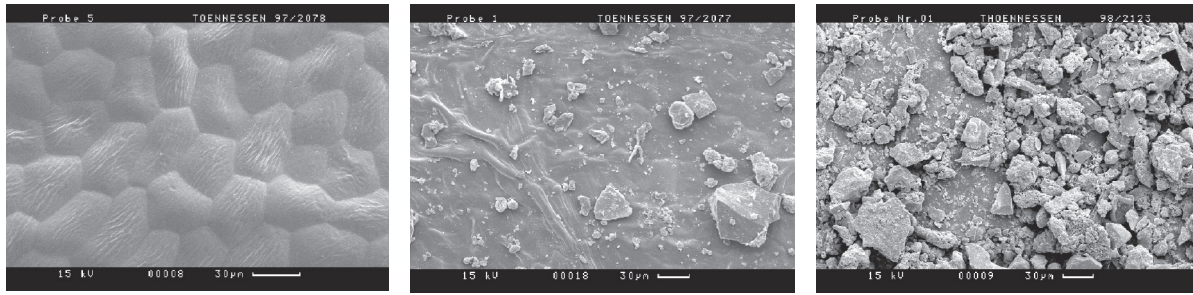
Authors: M. Bruse, M. Thönnessen and U. Radtke, 1999

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**Hypothesis:** Green Facades supporting climbing plants are an effective and inexpensive means to address air pollution by automobile traffic in urban canyons. Plant leaves have a ‘filter effect’ by capturing heavy metal particles present in gasoline and diesel emissions, particularly Cadmium and Lead, on the leaf surface. The particles are absorbed by the leaf structure and remain there, reducing the airborne volume of heavy metal particles and improving air quality.

**Method:** Seven buildings in an urban area of Düsseldorf (Germany) were vegetated with Japanese Creeper (*Parthenocissus Tricuspidata*) with a homogenous thickness of between 30 to 40 cm (12 – 16”) thick and at heights from 15 to 20 m. (49 – 66’) At different times within the years 1991–1997 leaf samples were analyzed for the concentration of several heavy metals (Cd, Co, Cr, Cu, Hg, Ni, Pb, Zn) using atomic absorption spectrometry. In order to separate the amount of heavy metals absorbed by the leaf surface (through airborne emission) from those parts being extracted from the soil by the plant roots, different cleaning techniques were tested to extract the particles from the leaf surface. Leaf samples were analyzed from spring through fall and the accumulation of particles on the leaf surface was photographed.



**Figure 1: Leaf stripped with Polyvinyl-Butyral (left), uncleaned leaf surfaces, June (middle) and October (right)**

The mechanics by which heavy metal particles are dispersed were reproduced by a computer model based on the field experiments. Results showed that the dispersion of heavy metals corresponded inversely to the height of the vegetated facade, in that the highest concentration of particles is found in the first 4.5m (13.5') of the vegetated facade above ground level.

**Conclusion:** This study shows that plant material can help to improve air quality around buildings that are affected by an urban canyon environmental condition. By absorbing heavy metal particles into the leaves they are removed from the surrounding air, demonstrating the potential of a vegetated façade to improve air quality in an urban canyon. As a result cleaner air is circulated in the A/C system because of the reduced quantity of particulate pollutants drawn into the building through intake vents.

**Recommended Design Strategies:**

- Place vegetated greenscreen® trellis panels on vertical surfaces near heaviest automobile traffic locations within the first 14' above ground for maximum effect
- Arrange vegetated panels around ventilation grilles to filter intake air.

