Indoor Air Biofilters

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PROJECT HISTORY
North Americans spend over 85% of their time indoors. With increasing energy costs, the maintenance of an adequate indoor condition is becoming very expensive. Since 1996 the University of Guelph has investigated biofiltration as an alternative means of indoor air quality control. In 2001, Dr. Alan Darlington (a co-investigator on the project) was awarded the Martin Walmsley Fellowship to commercialize the technology.

THE PROBLEM
- Canada has an extreme climate
- To provide adequate environment, buildings are air tight
- Sealing the building allows contaminants to accumulate
- Contaminants arise from materials used indoors

Traditional Solution
- Contaminants removed by ventilation
- Displace indoor air with new outside air
- This new air is often too hot or cold,
- Air must be 'conditioned' before use
- Requires considerable energy and cost

THE SOLUTION
- BIOFILTRATION of Indoor Air

How does it work?
- Air drawn through wet "biomass"
- Contaminants move from air to water
- Broken down by biologicals
- Green plants improve effectiveness
- Reduces need for outside 'fresh air'

The benefits of biofilters
- Improved air quality
- Reduced energy consumption
- No hazardous waste
- Disposal issues
- Easily retrofitted into existing building
- Aesthetic appeal
- Wide range of application
- A safe technology
- Airborne spores not a problem

How well does it work?
- Contact time less than 1 second
- Single pass removes
  - >90% formaldehyde
  - >50% toluene
- May require some acclimation
- Able to remove 'new' VOCs without changing system
- Able to maintain air quality in 'sealed' indoor spaces

What size of biofilter is needed?
- Depending the site, 1 m of biofilter will cleanse 50 -100 m² of floor space
- For larger areas, multiple biofilters can be used or larger custom units can be designed

Current products
- Onboard air-handling system
  - 4 m² of 'biofilter'
  - 75 litre aquarium
  - 0.5 m² of hydroponic planting
  - Automated controls

Future products
- Industry
- Agriculture
- Residential
- Large scale systems
- Military
- Space

This project has been supported by the Centre for Research in Earth and Space Technology (CRESTech), NORCAT and Canada Life Assurance.

Some emission levels from "Low-Emitting" products (Black, 1997)

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>COMMON TVOCs</th>
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<tr>
<td>Wall Coverings</td>
<td>Formaldehyde, Acetone, Acetic acid, Hexanal</td>
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| Paints | Propylene glycol, Butyl |}

Plants improve the efficiency of the biofilter through direct uptake of pollutants and improving microbial activity.

An artist representation of our original research venue at the Canada Life Environmental Room (Toronto, ON) Air from the room is drawn through the biofilter and then returned to the room. (Drawing courtesy of Canada Life Assurance)

Our initial research venue at CANADA LIFE ASSURANCE Toronto Head office commissioned with semi-tropical house plants.

The new biofilter being constructed at NORCAT (Northern Centre for Advanced Technology) in Sudbury Ontario. This biofilter was commissioned with northern Boreal species.

The impact of biofilters on the formaldehyde levels in indoor spaces

Contaminants removed by the biofilter initially being produced. Air is cleaned by drawing it through the plant covered walls by an on-board fan system. The cleaned air is returned to the room from the top of the unit. This cleaning process reduces the need to go outside to get fresh air to maintain indoor air quality.

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