

Waste air treatment by biofiltration: A sustainable strategy

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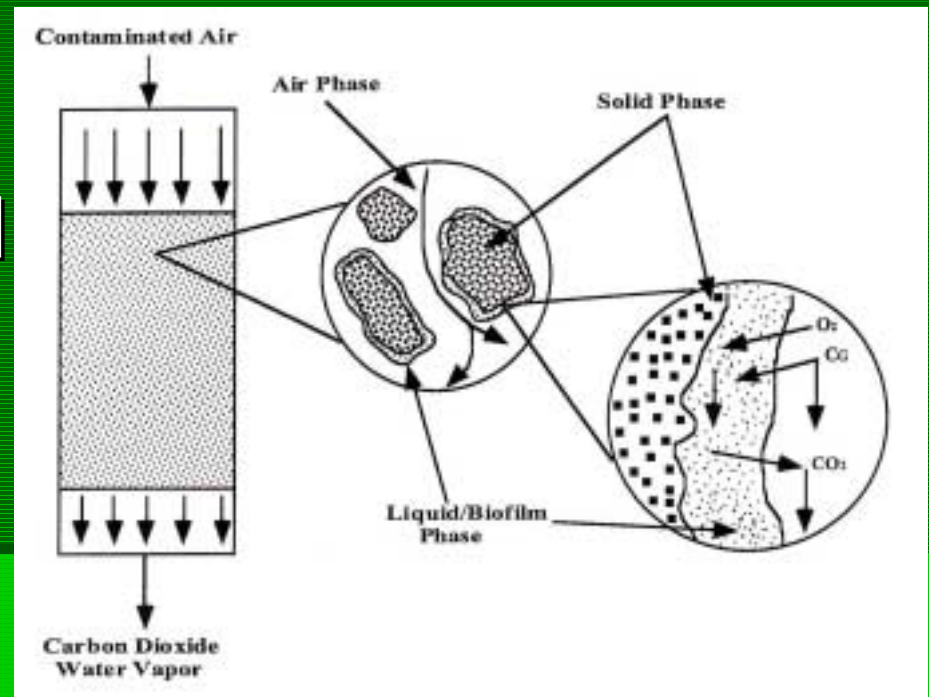
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Outline

- Introduction
- On-going Project
- Proposed project
- Conclusions

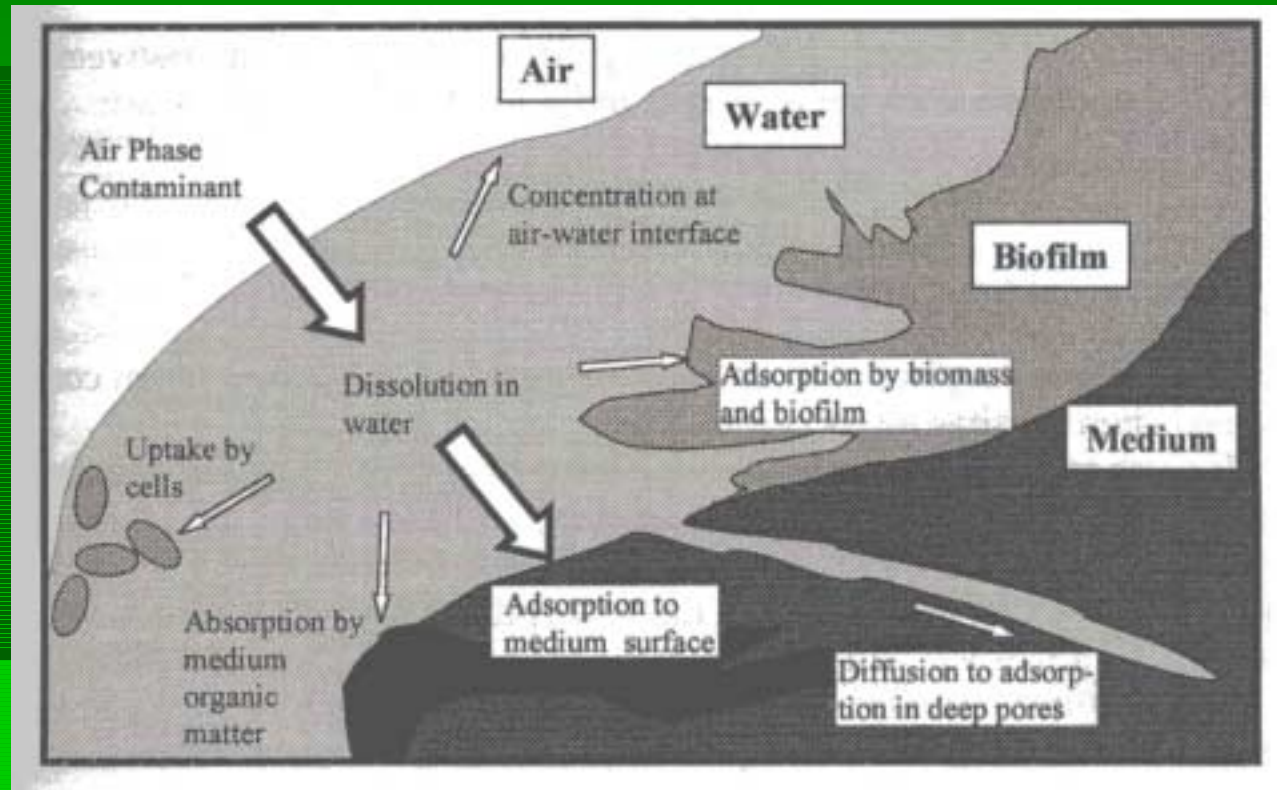
Introduction

- Biofiltration is a process in which micro organisms fixed to a porous medium break down contaminants present in an air stream.



(Source: Devigny et al. 1999)

Contaminant Removal



(Source: Devlin et. al. 1999)

Advantages

- Low capital costs compared to other air pollution control equipment
- Low operating costs
- High removal efficiencies
- Operates at ambient temperature
Byproducts are harmless CO₂ and H₂O.

Applications

- Agricultural industry (e.g. livestock units)
- Food processing
- Waste water treatment
- Other industrial emissions

Agricultural Applications



- Shallow depth
- Large surface area
- Vertical air movement through the media
- Wood chip and compost media

Winter Operation



Biofilter Media

- The biofilter media refers to a pile of porous filter materials
 - houses the micro organism
 - serves as the microbial growth environment
 - provides favourable conditions for the process

Biofilter Media

- Filter materials mostly consist of
 - biological residues: yard waste, grocery waste, poultry manure, top soil
 - inert bulking agents: wood chips, wood mulch, straw

Testing of Media Mixtures

Media Mixture

Type of Compost	Type of Bulking Agent
Yard waste	Wood chips
Grocery waste	Wood chips
Poultry manure	Wood chips
Grocery waste	Hemp hurds
Grocery waste	Straw
Topsoil	Straw

(DeBruyn et al. 2001)



-Filter composition was 50:50 mixture by mass

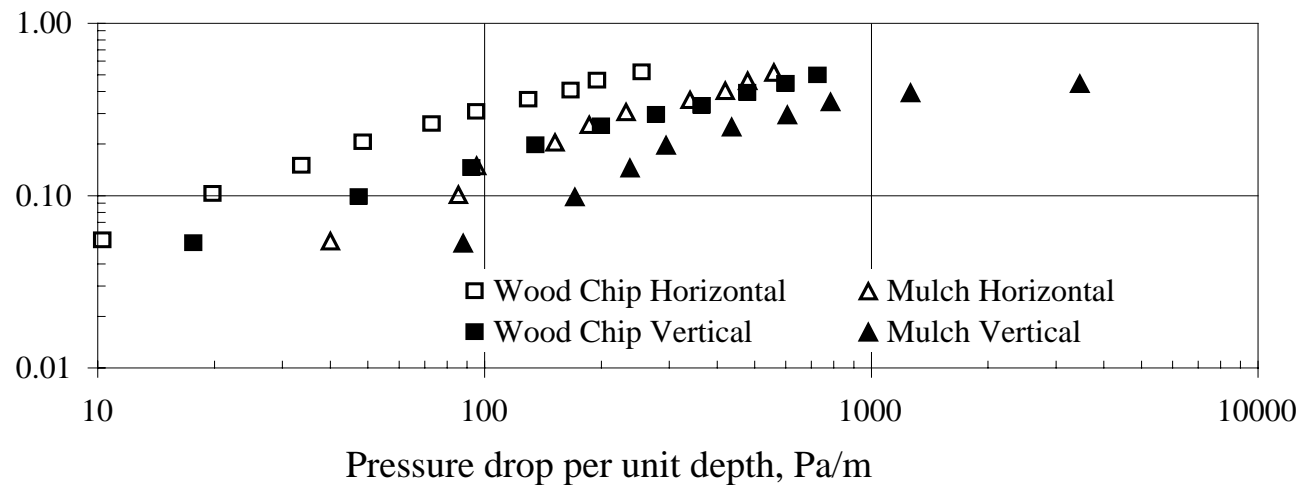
Residual Odour

Mixture	Location	Odourous-air Biofilter	Clean-air Biofilter
	inlet	958 OU	34 OU
Yard waste compost & wood chips	outlet	36 OU	30 OU
Grocery waste compost & wood chips	outlet	51 OU	40 OU
Grocery waste compost & hemp hurds	outlet	22 OU	51 OU

On-going Project

- Currently, work is going on in the following areas:
 - Airflow direction
 - Different irrigation systems
 - Effect of additional minerals: Zeolite

Airflow Direction: Horizontal vs. Vertical



(Source: Sadaka et al. 2002)

Horizontal Biofilter



- Central plenum divides the biofilter into two halves
- Air moves sideways rather than vertical

Irrigation System and Zeolite

- Irrigation systems:
 - Irrigation
 - Pre-humidification
 - Natural
- Zeolite



Proposed Projects

- Determine pressure exerted by different filter materials on the wall of the biofilter
- Device an integrated systems that will be economical to the farmer

Lateral Pressure on walls

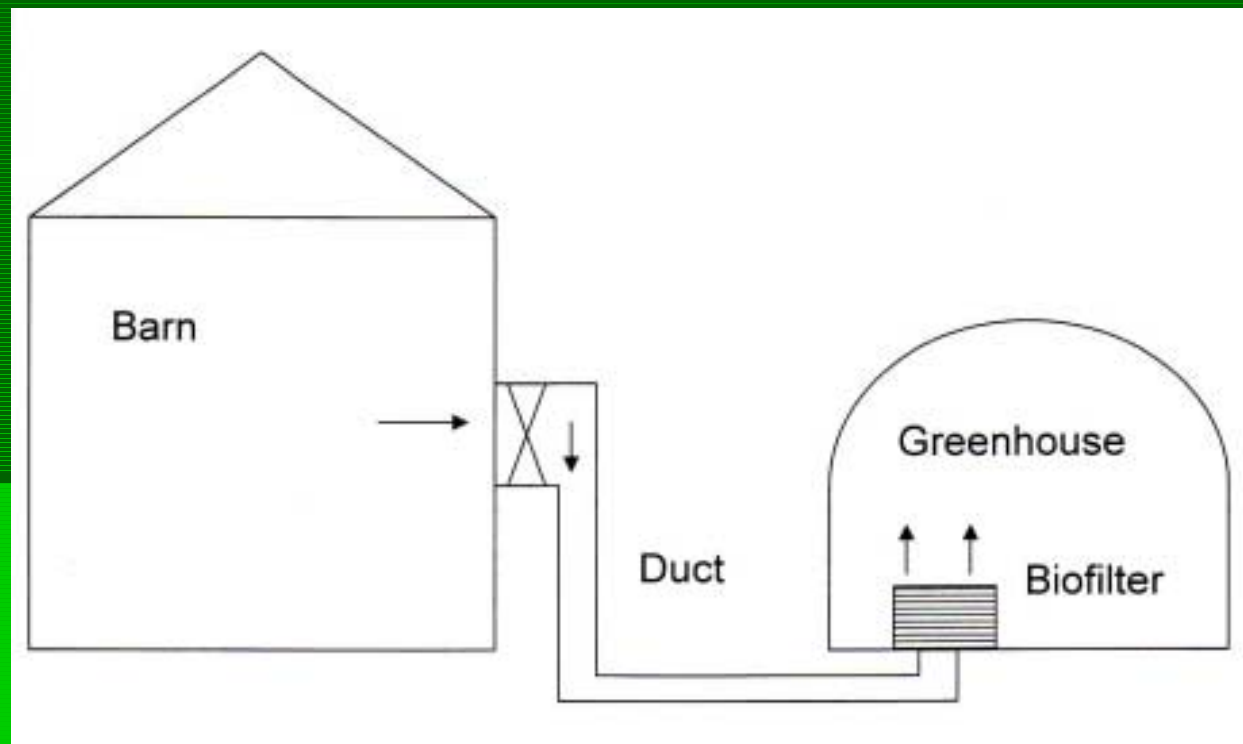


- Filter materials exerts pressure on biofilter walls
- Pressure could cause structural failure

Lateral Pressure Tests

- Determine effect of moisture on lateral pressure
- Compare different media compositions in terms of lateral pressure
- Investigate the impact of wetting-drying cycles on lateral pressure
- Develop a model for determining pressure on biofilter walls

Integrated Barn-Biofilter-Greenhouse System



Conclusions

- Biofiltration is a biological odour control technology
- Biofiltration is capable of treating exhaust air from livestock units
- Biofiltration is cost effective and easy to operate
- For optimum performance, biofilter media should contain some biological residue mixed with inert bulking agents

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Questions?