

# **BIOTREATMENT OF ODORS AND VOLATILE COMPOUNDS**

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# ABOUT PRD TECH

- *Experienced Company with extensive research background in Biofiltration*
- *Installed full-scale Biofilters and Retrofitted existing Scrubbers into Biofilters*
- *Wide range of contaminants ( $H_2S$ ,  $NH_3$ , VOCs)*
- *No Media replacement – 10 year media life*
- *Small footprint (Gas Velocity > 100 ft/min.)*

# What is the Problem ?

- **Organic (aldehydes, etc.) and inorganic (hydrogen sulfide, etc.) odors are emitted from headworks, sludge handling operations and anaerobic digesters.**
- **Volatile Organic Compounds (VOCs) are emitted from aeration basins and clarifiers.**
- **Odors are a nuisance to plant personnel and surrounding communities.**
- **VOC's may be toxic and result in pollution of the surrounding air.**

# Your Choices for Odor Control

- 1. Chemical Oxidation – oxidation of odorous compounds by oxidizing agents, such as sodium hypochlorite, chlorinated H<sub>2</sub>O, potassium permanganate, hydrogen peroxide, ozone, etc.**
- 2. Thermal Destruction – destruction of odorous compounds at high temperature either catalytically or in gas combustors**
- 3. Carbon Adsorption – elimination of odors using activated carbon as an adsorption media**
- 4. Biological Treatment - conversion of odorous compounds to carbon dioxide and water by aerobic microorganisms**

# CHEMICAL OXIDATION

- **Requires oxidizing agents, such as hypochlorite, ozone, chlorine gas, etc.**
- **Chemical handling and storage is required.**
- **High operating cost due to consumption of oxidizing agents.**
- **By-Products - Chlorine gas, Halocarbons (Carcinogenic)**

# CHEMICAL OXIDATION cont'd.

- **Exhibits high removal efficiency for water soluble compounds only.**
- **Cannot reduce emissions of volatile organics due to higher concentration.**
- **Effective for inorganic odors such as hydrogen sulfide and less effective for organic odors.**

# THERMAL OXIDATION

- Requires high temperatures
- High operating cost due to consumption of natural gas
- Produces nitrogen oxides (a regulated pollutant)
- High initial equipment cost
- For catalytic oxidation, periodic replacement of catalyst is required due to deactivation, sintering or poisoning

# OTHER OPTIONS

- **WATER SCRUBBING**
  - **Capable of removing compounds with high water solubility**
  - **Removal Efficiency too low for use as an effective Odor Control operation**
  
- **INJECTION OF SCENTS**
  - **Masks instead of removing odors**
  - **Does not affect concentration of volatiles**
  - **Masking effect decreases with distance due to differences in diffusion rates**

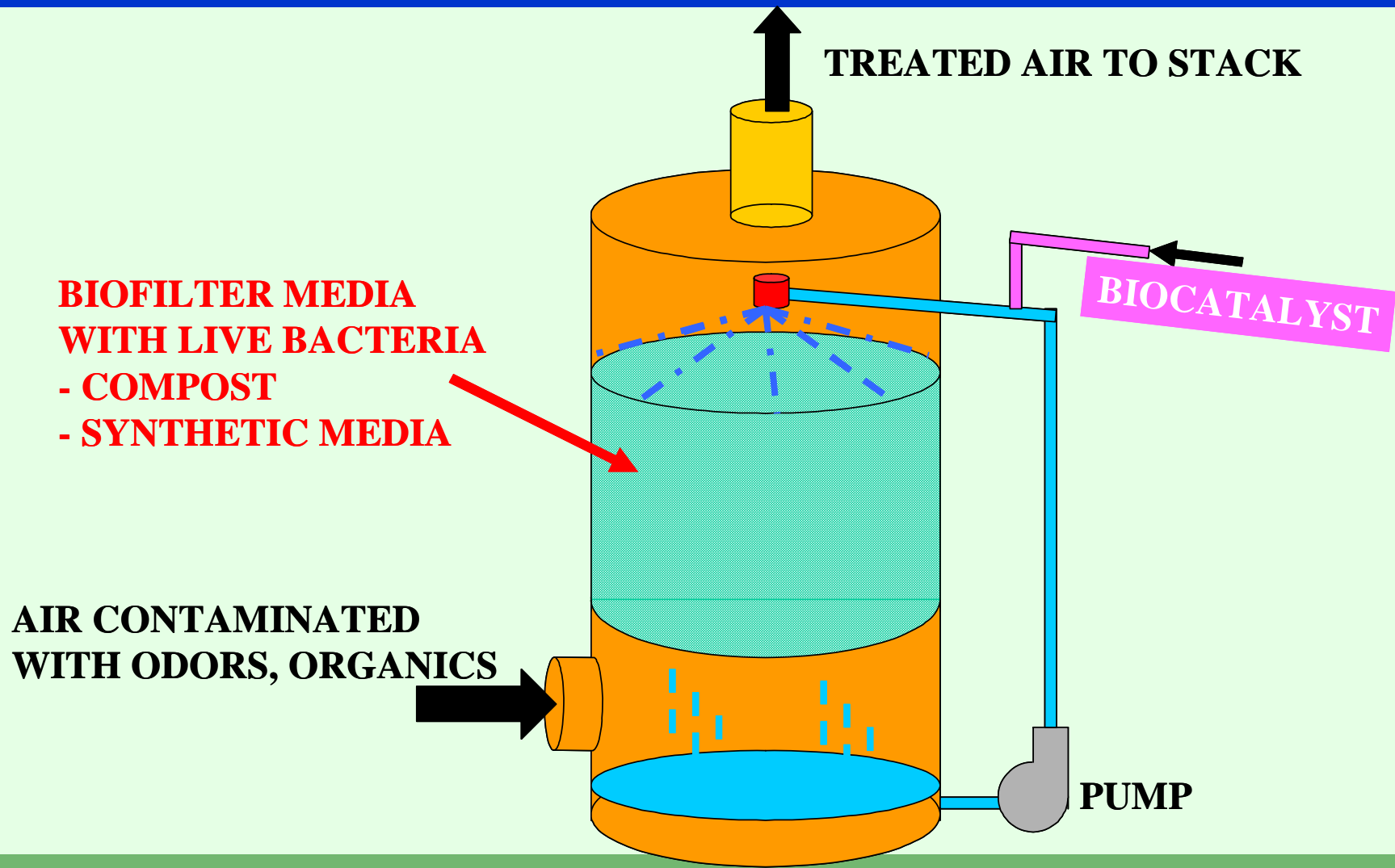
# BIOFILTRATION

- **Involves direct biological transformation with minimal gas-phase residence time (0.1 - 10 seconds)**
- **Can biodegrade odorous compounds *and* volatile organics, as well as hydrophilic (high water solubility) *and* hydrophobic (low water solubility) compounds**
- **No handling or storage of hazardous chemicals**
- **Energy efficient – requires no heat or fuel consumption**
- **Does not generate chemical by-products**
- **Environmentally friendly and safe technology**
- **Low capital & operating cost**

# TYPES OF BIOFILTERS

- Naturally Bioactive Media:**  
**peat, compost, wood chips, etc.**
- Synthetic Support Media:**  
**plastic, ceramic, etc.**

# TYPICAL BIOTRICKLING FILTER



# **SOIL, PEAT, COMPOST, WOOD CHIPS BIOFILTERS**

- **Eventual Media Replacement – Problem**
- **Gas by-passing and maldistribution**
- **Settling of media**
- **Requires pre-humidification and control of water content**
- **Limited biodegradation capacity**
- **Low gas velocity – large footprint**

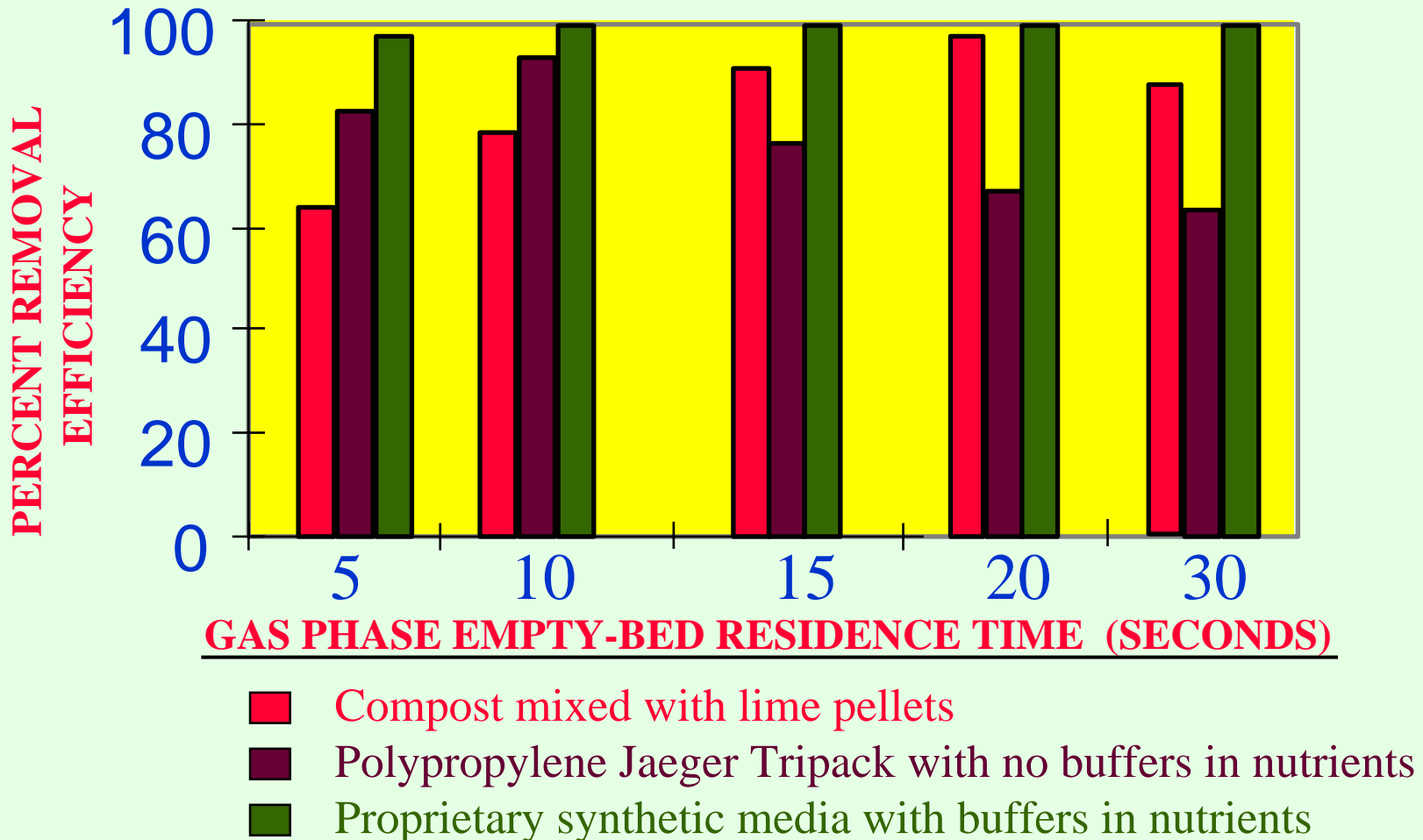
# **PRD Tech**

## **SYNTHETIC SUPPORT MEDIA**

- **Low Pressure Drop – Smaller Blower, Less energy cost**
- **No pre-humidification necessary**
- **No media replacement**
- **Can handle significantly higher compound concentrations**
- **High gas velocity – smaller footprint**

# ODOR TREATMENT

(Hydrogen Sulfide 50 ppmv)



# PICTURE OF PLANT AND SURROUNDING TERRAIN



**Dry Creek Wastewater Treatment Plant – Erlanger, Kentucky**

# ZIMPRO STACKS WITH THE RIDGE IN THE BACKGROUND



**PRD Tech Inc.**

**15,000 CFM  
biotrickling filter**

**Dry Creek  
Wastewater  
Treatment Plant**

**Erlanger, Kentucky**





**PRD Tech Inc.**

**60,000 CFM  
bioscrubber**

**Dry Creek  
Wastewater  
Treatment Plant**

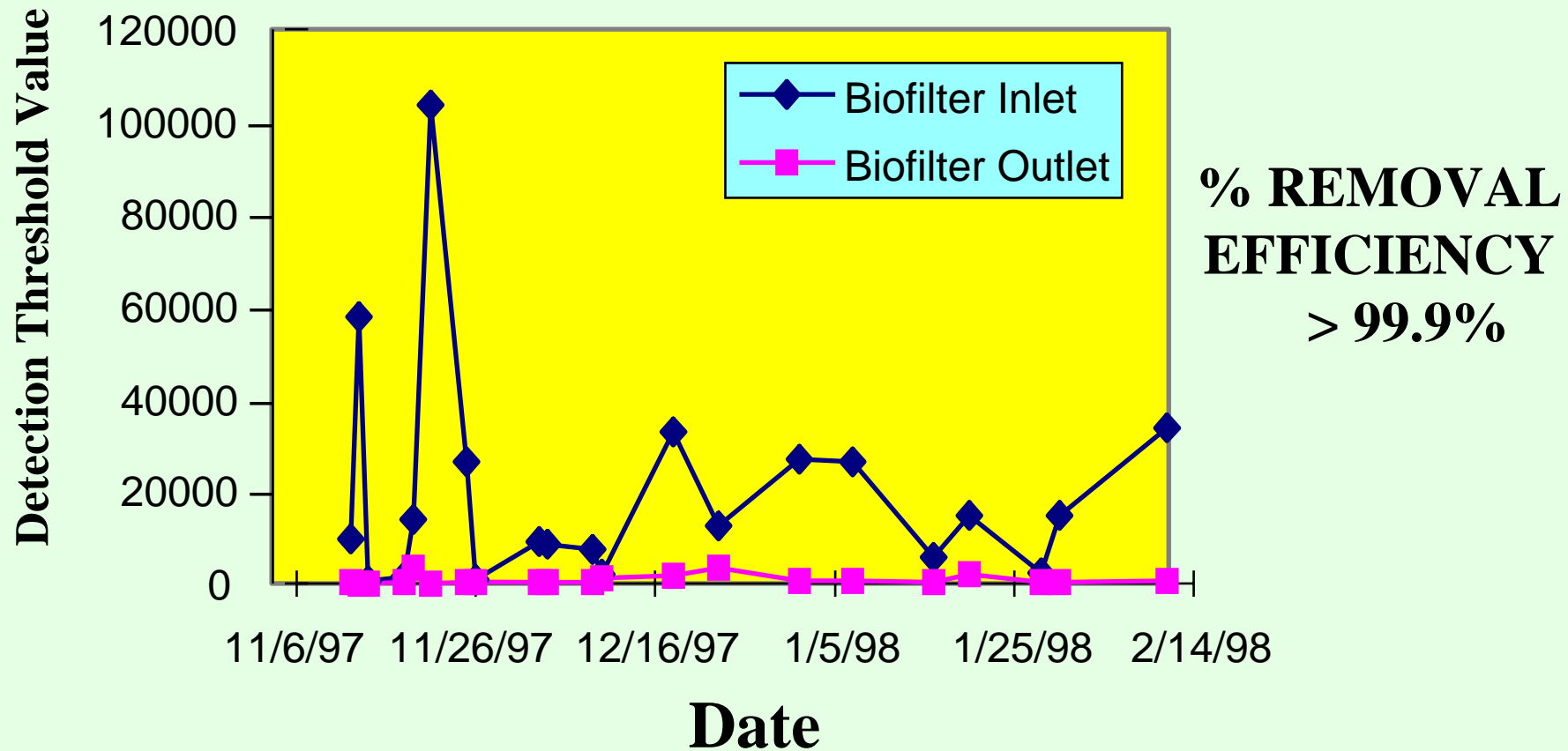
**Erlanger, Kentucky**

# PRD Tech Inc.

## Control Computer

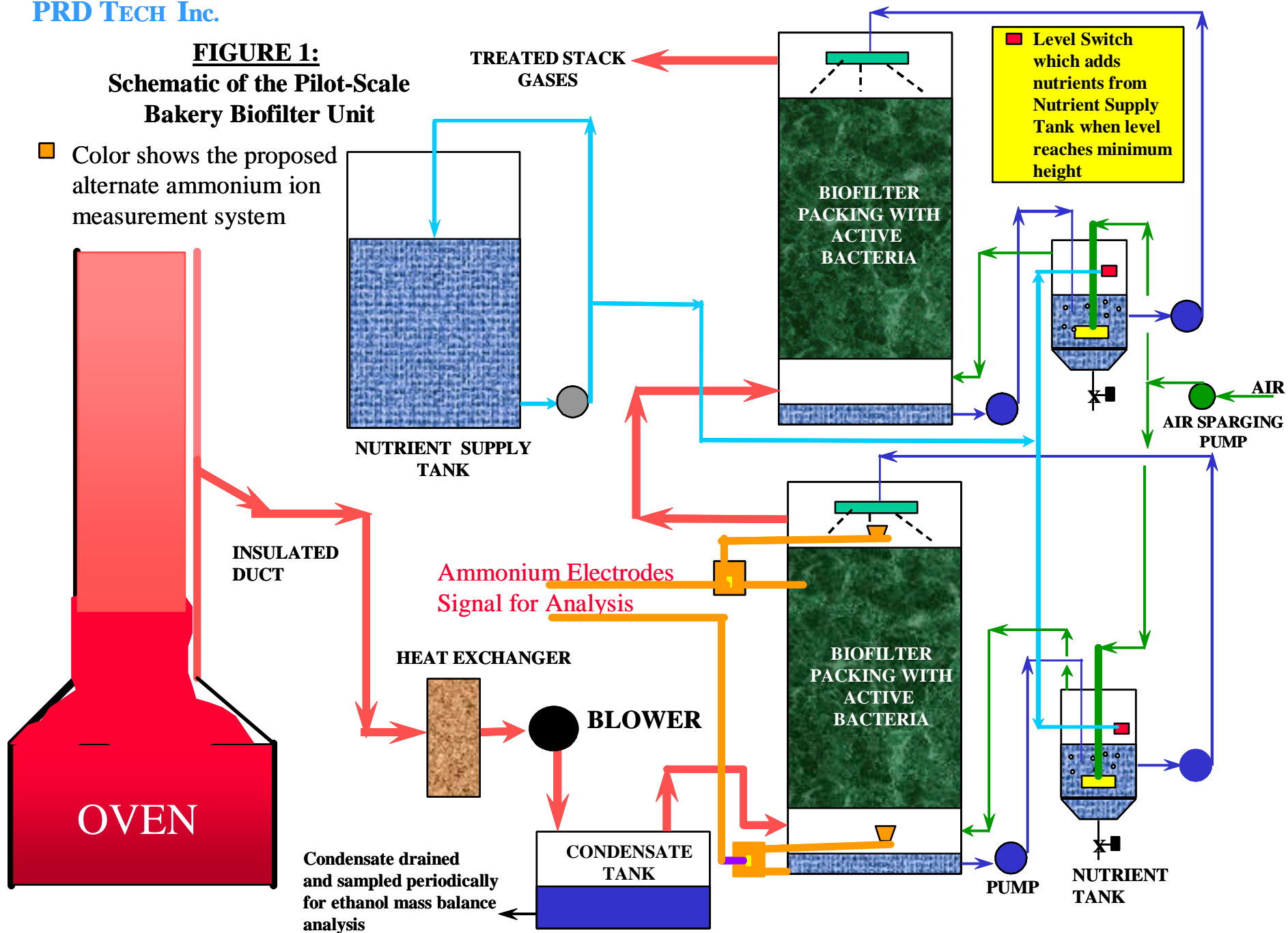


# ODOR TREATMENT FROM SLUDGE CONDITIONING (ZIMPRO) PROCESS



**FIGURE 1:**  
**Schematic of the Pilot-Scale**  
**Bakery Biofilter Unit**

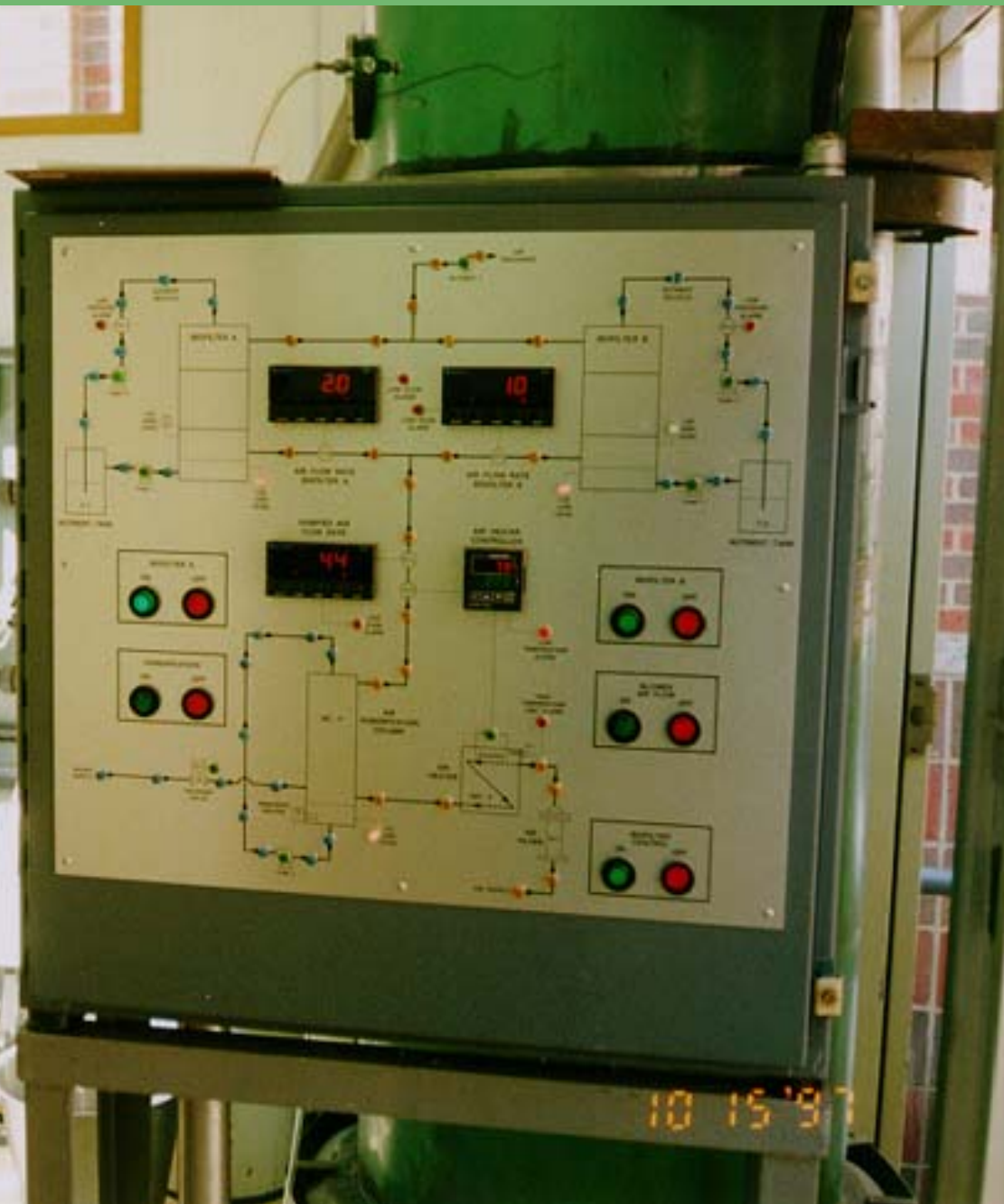
Color shows the proposed alternate ammonium ion measurement system





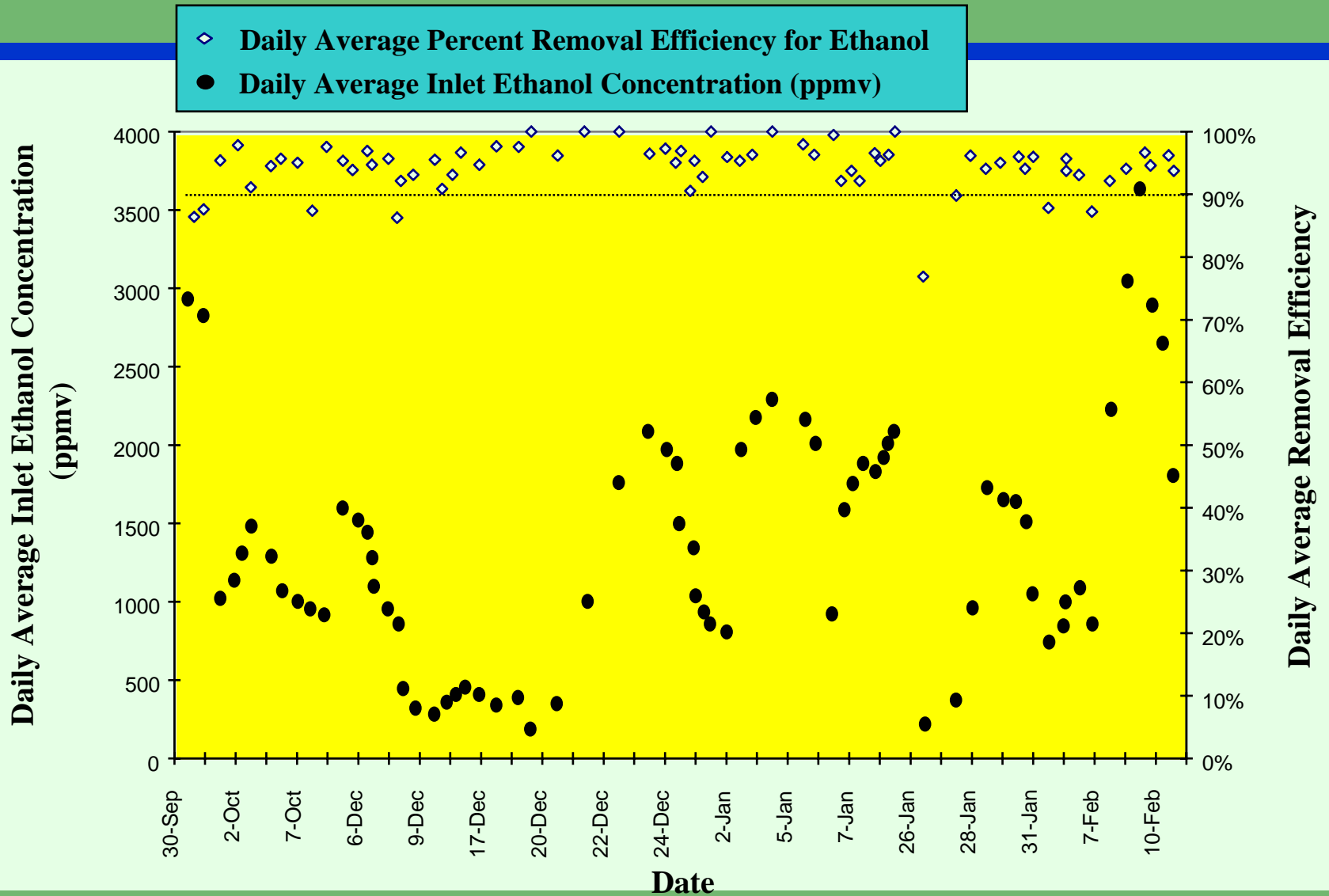
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# BIOTREATMENT OF ETHANOL FROM BAKERY EXHAUST GASES



# What can you treat ?

- **Hydrocarbons – Aliphatic, Aromatic**
- **Organics – Aldehydes, Ketones, Alcohols**
- **Inorganics – Sulfides, Ammonia, ...**
- **Reduced Sulfur Compounds – Mercaptans  
Disulfides, ....**
- **Odors**

# APPLICABILITY

**AIRFLOW (thousands CFM)**

0 10 20 30 40+

**BIOFILTRATION**

**ADSORPTION**

**SCRUBBERS**

**INCINERATION**

**CONDENSATION**

**CONCENTRATION (ppmv)**

0 250 500 750 1,000

**BIOFILTRATION**

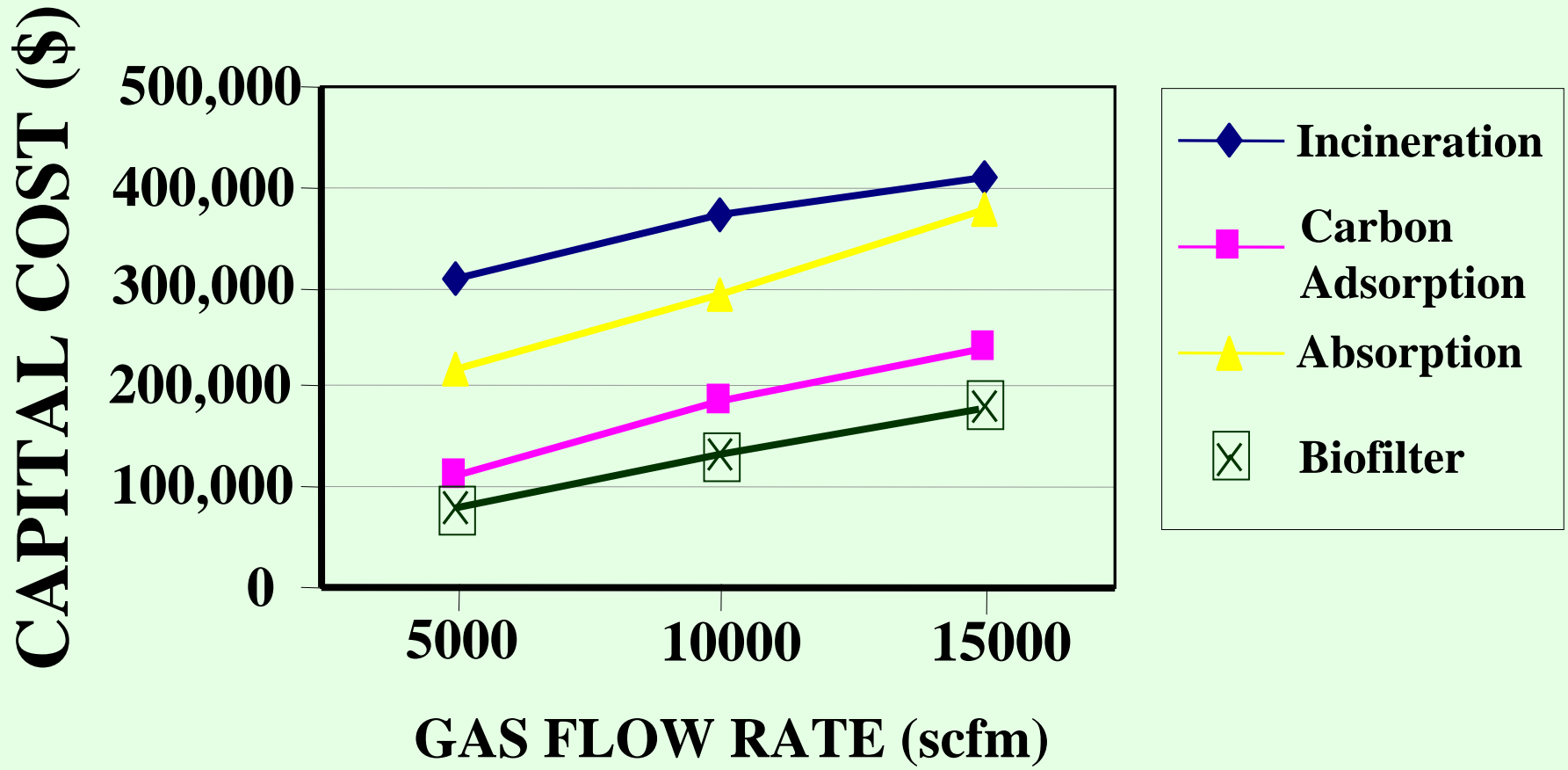
**ADSORPTION**

**SCRUBBERS**

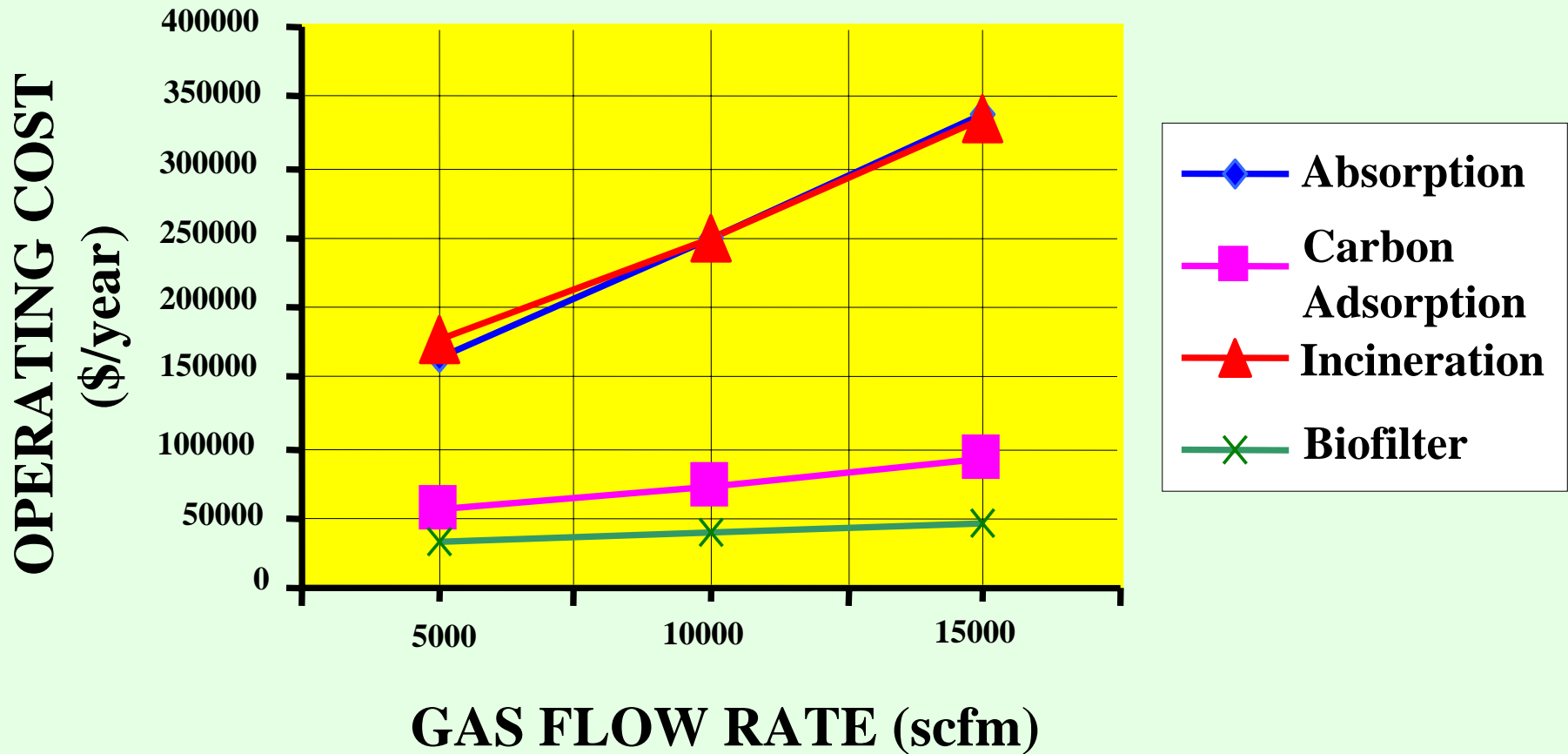
**INCINERATION**

**CONDENSATION**

# COMPARATIVE COST ANALYSIS (CAPITAL COST)



# COMPARATIVE COST ANALYSIS (OPERATING COST)



# CONCLUSIONS

- ❑ Biofiltration is an emerging technology with great potential for treating odors and VOC emissions from wastewater treatment plants and industrial production processes**
- ❑ Biofiltration does not consume any fuel or produce any hazardous by-products**
- ❑ In biotrickling filters, the media has a major impact on performance and design**

# CONCLUSIONS (cont'd)

- ❑ Biotrickling filters have distinct advantages over compost biofilters**
- ❑ Biotrickling filters have shown very high removal efficiencies for control of odors and VOC's**
- ❑ Biotrickling filters are very cost-effective compared with thermal treatment, chemical oxidation, carbon adsorption, and absorption.**