



The Science of Odour Control Applied at the Edmonton Waste Management Centre

Laura Hauptert, Ph.D.

R & D Scientist – OMI Industries

Waste reForum 2014 Co-Conference



Edmonton Waste Management Centre



- “Odour Management at the Edmonton Waste Management Centre” – by Heather Speers (From Waste Management Services)



- 550 Acres

Integrated Processing and Transfer Facility



- Incoming waste is sorted here (Odour Issues)
 - Organics for composting
 - Materials for recycling
 - Materials for conversion to ethanol
 - Biosolids for compost
 - Waste for landfill



Edmonton Composting Facility

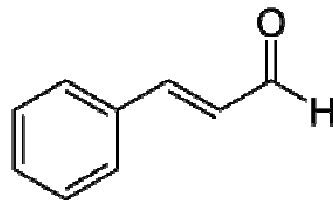


- Produces Compost
 - Biosolids
 - Organics
- Aeration Bays
- Odour Control

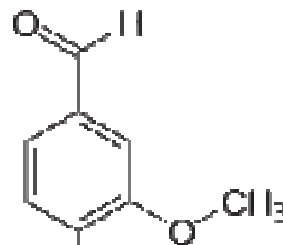


Odour

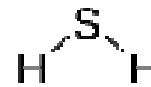
- The property or quality of a thing that affects, stimulates, or is perceived by the sense of smell
 - Odours can be a mixture of gas molecules
 - Odours can smell good or bad



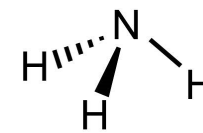
Cinnamaldehyde



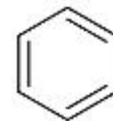
Vanillin



Hydrogen Sulfide



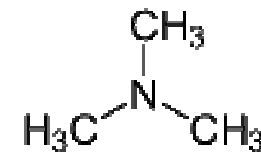
Ammonia



Benzene



Pyridine



Trimethylamine



Odour Categories

Bases

- Butylamine
- Dibutylamine
- Diphenyl Sulfide

Acids

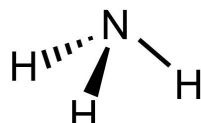
- Methyl Mercaptan
- Hydrogen Cyanide
- Sulfur Dioxide

Neutrals

- Styrene
- Acetaldehyde
- Chlorine



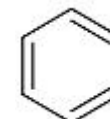
Pyridine



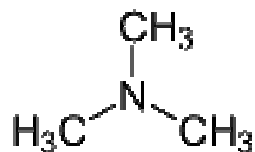
Ammonia



Hydrogen Sulfide



Benzene

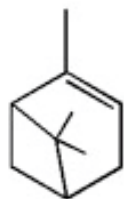


Trimethylamine

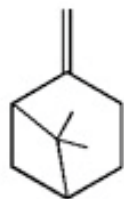


Odour Control Using a Blend of Essential Oils

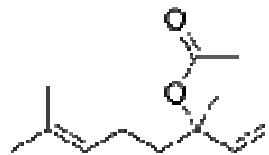
- A proprietary blend of essential oils used in a formulation for either water based or oil based applications
 - Essential oils - volatile organic oils present in plants



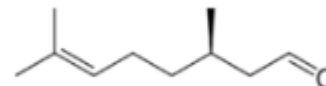
α - pinene



β - pinene



Linalyl Acetate



Citronellal

- Water based - essential oils, surfactants and water
 - Contains neutral organic compounds and organic buffers
 - pH between 5.5 and 8.5

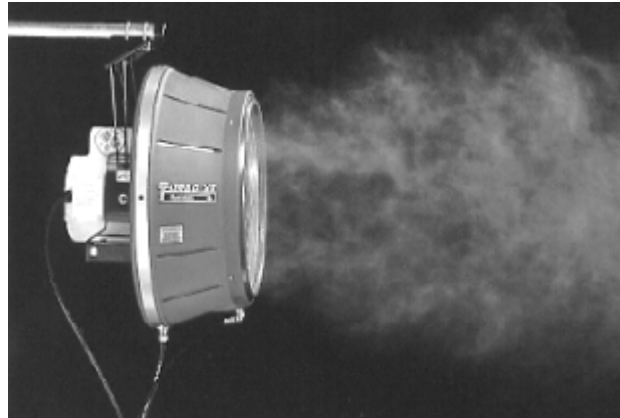


Delivery Systems for Airborne Treatment

Atomizing Nozzle



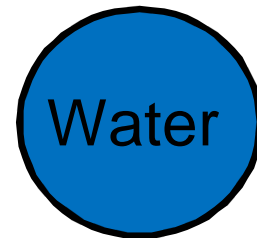
Hollow Bladed Fan



Vapor Phase System



Atomize Odour Control Blend into droplets



Non Polar
Essential Oils

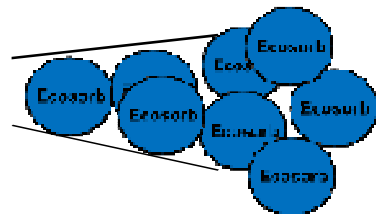
How Our Product Works Without Being a Mask

- Contact – Van der Waals interaction
 - Electrostatic charge
 - Positive vs. negative
- Adsorption – binding of molecules to a surface
- Absorption – molecules enter a bulk phase
- Solubility – ability of molecules to dissolve into water
- Distribution Constant – gases in solution want to be in a state of equilibrium.
- Reactions – mostly acid / base

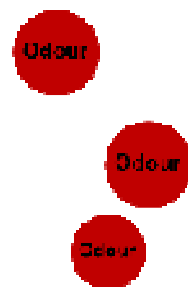


How Our Product Works - Adsorption

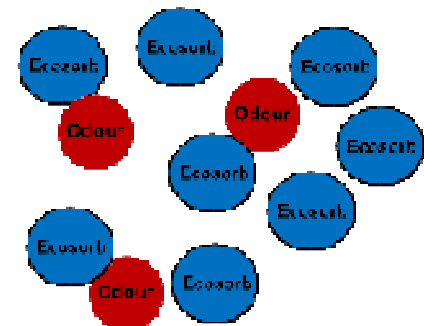
- Make Contact – Van der Waals interaction
 - Electrostatic charge
- Adsorption – binding of molecules to a surface
 - Surface area



Atomization of
our product



Odours



Odour control
through adsorption



How Our Product Works - Absorption

- Absorption – molecules enter a bulk phase
 - Molecules taken up by the volume not surface
 - Odour under control
 - Affected by the solubility of the molecule



How Our Product Works - Solubility

- Solubility – ability of molecules to dissolve into water
 - Our product enhances the solubility of many gases
- Dr. Wilkinson - “Efficiency in removing malodors is proportional (α) to solubility of the malodor”

$$\text{SOLUBILITY} = \frac{[\text{CONC}] [\text{TIME}] [\text{VEL}] [\text{POL}]}{\text{DROPLET SIZE}}$$

CONC – Increase product concentration

TIME – Increase contact time

VEL – Increase velocity of droplet

POL – Changing polarity of droplet

DROPLET SIZE – Decrease the droplet size



How Our Product Works– Distribution Constant

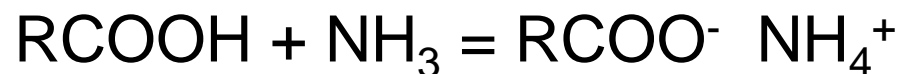
- Distribution Constant – gases in solution want to be in a state of equilibrium.
 - Equilibrium between vapour and aqueous phases
- Our product allows for a large increase in distribution constant between gas molecules in vapour and aqueous phases
 - Polarity, pH and reaction with our product
 - Increase in amount of gas trapped in aqueous layer
 - Increase in odour control



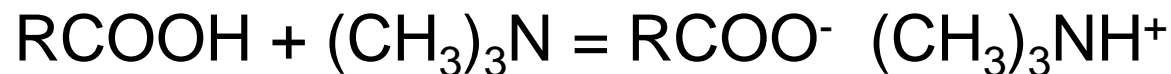
How Our Product Works – Bases Reactions

- Our product contains organic acids (RCOOH) that will react with bases
 - pH plays a role

Ammonia

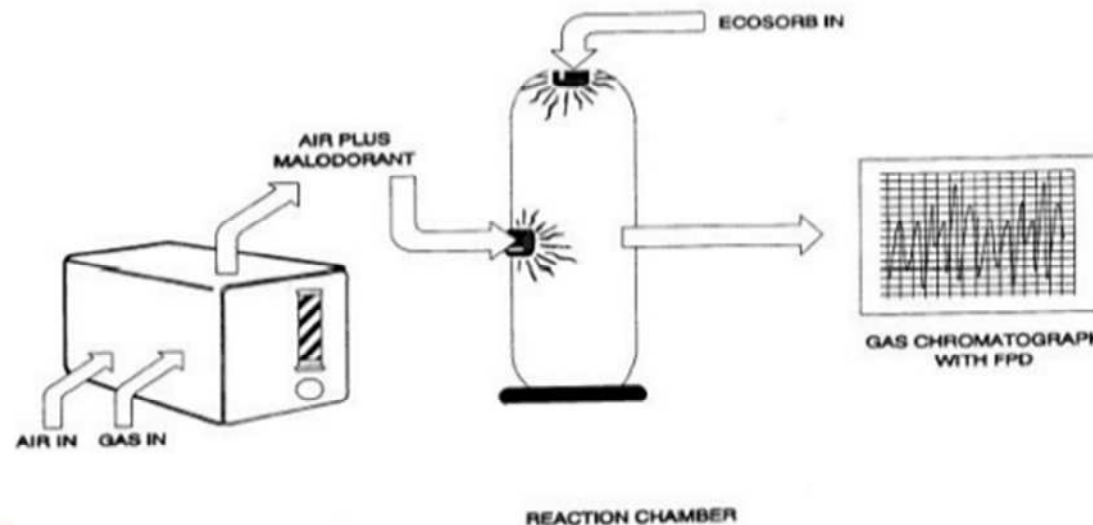


Trimethylamine



3rd Party Test with Ammonia

- Testing Done by Southern Petroleum Lab
- Ammonia tested with our product using flame photometric detection gas chromatography
- 103 ppm of Ammonia initially
- 68 ppm of Ammonia immediately after treatment
- 38 ppm of Ammonia 15 minutes after treatment



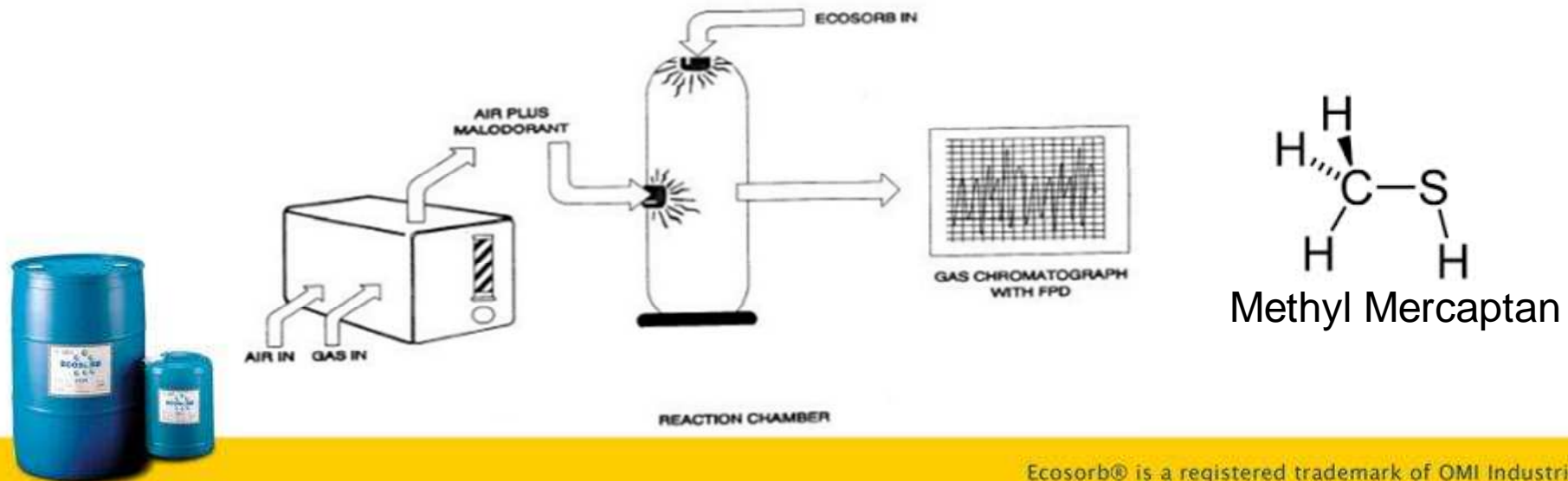
How Our Product Works – Acids Reactions

- Acids such as Hydrogen sulfide can react with our product (R=CHCHO) by addition across double bonds



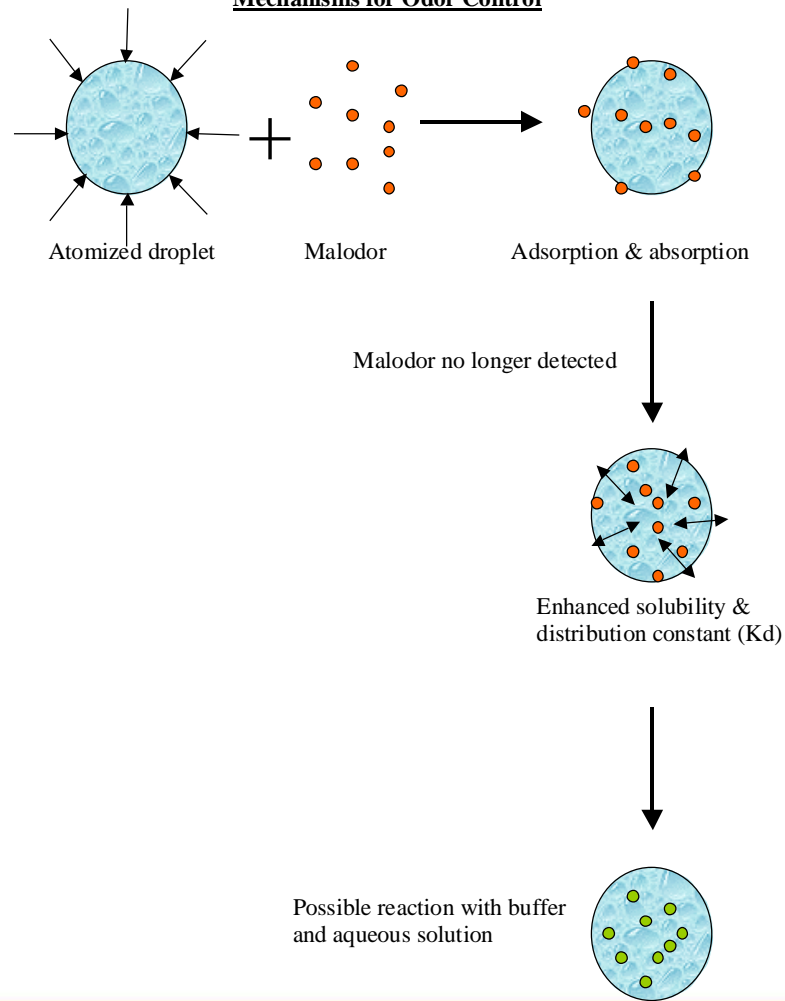
3rd Party Test with Methyl Mercaptan

- Testing Done by Southern Petroleum Lab
- Methyl Mercaptan tested with our product using flame photometric detection gas chromatography
- 3.20 ppm of Methyl Mercaptan initially
- <0.1 ppm of Methyl Mercaptan immediately after treatment
- <0.1 ppm of Methyl Mercaptan 15 minutes after treatment



Our Products Mechanism

Mechanisms for Odor Control



Our product at the Integrated Processing and Transfer Facility

- 600 CFM vapor phase unit
- High pressure blower
- Sub-micron droplets of our product
- Dry spray



OMI WORLDWIDE | COMETOGETHER

Our Product at the Integrated Processing and Transfer Facility



OMI WORLDWIDE | COMETOGETHER

Our Product at the Integrated Processing and Transfer Facility



Summary

- Edmonton Waste Management Centre has odour problems
- Ecosorb[®] neutralizes odours by up to 5 different mechanisms
 - Adsorption, Absorption, Solubility, Distribution
Constant and acid/base reactions
- Ecosorb[®] effectively removes odours at Edmonton Waste Management Centre



References

- Odour Management at the Edmonton Waste Management Centre” – by Heather Speers (From Waste Management Services)
- C. King Lee – TDH Fluid System Inc.
- Ying Zhang, R.W. Hurd, and Donald R. Wilkinson – Delaware State University
- Heather Speers and Lena Aitken – Edmonton Waste Management Centre
- Edmonton Waste Management Centre



Questions ?

Thank You!

