Development of an Anesthetic Reflection System

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Global Warming Potential of Anesthetic Gases


<table>
<thead>
<tr>
<th>Compound</th>
<th>Atmospheric lifetime (y)</th>
<th>Radiative efficiency (W m⁻² ppb⁻¹)</th>
<th>GWP 20-y time horizon</th>
<th>GWP 100-y time horizon</th>
<th>GWP 500-y time horizon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isoflurane</td>
<td>3.2</td>
<td>0.453</td>
<td>1800</td>
<td>510</td>
<td>160</td>
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<tr>
<td>Sevoflurane</td>
<td>1.1</td>
<td>0.351</td>
<td>440</td>
<td>130</td>
<td>40</td>
</tr>
<tr>
<td>Desflurane</td>
<td>14</td>
<td>0.469</td>
<td>6810</td>
<td>2540</td>
<td>130</td>
</tr>
</tbody>
</table>
“...44,000-98,000 people die in U.S. hospitals each year as a result of preventable medical errors...”

Kohn LT, et al; To Err Is Human: Building a Safer Health System.

“DALYs from deaths due to preventable medical errors are of the same order of magnitude as the 470,000 DALY lost due to health care-related emissions.”

Eckelman, M., et al; Environmental impacts of the U.S. health care system and effects on public health.
Investigating Porous Materials

Designing the Anesthetic Reflector

Designing the Anesthetic Reflector
Saturation of the activated charcoal filter took approximately 6 minutes during a mock induction.

Following filter saturation, the hysteresis controller was able to maintain isoflurane concentrations within 0.2% by volume of a user set point (1 MAC).

Given a cartridge with 40 grams of activated charcoal, this system would be capable of reflecting 1 MAC/hour of anesthetic gas at FGF of 1 LPM.
Future Considerations for the Anesthetic Reflector

- Finding an alternative to activated charcoal.
  - Silica Gels
  - Zeolites
  - Metal-organic frameworks

- Improved feedback control
  - Replace hysteresis with PID control
  - Include material sorption isotherm
  - Mainstream anesthetic sensor

Thank You

Questions!