Recent Advances in Catalysis for the Measurement of CO, CO$_2$, and Formaldehyde

Rajvi Mehta
October 17, 2018
Gulf Coast Conference
Measuring CO, CO$_2$, & Formaldehyde

- Applications
  - Ethylene/propylene production
  - Air quality
  - Transformer oil gas analysis
  - Renewable Fuels
  - Beverage
  - Catalysis
Measuring CO, CO$_2$, & Formaldehyde

• Applications
  • Ethylene/propylene production
  • Air quality
  • Transformer oil gas analysis
  • Renewable Fuels
  • Beverage
  • Catalysis

• Analytical Techniques
  • GC-TCD
  • GC-MS
  • GC-Methanizer-FID
GC is Evolving to Meet Scientists’ Needs

Columns

Packed

Capillary

GCs

HP 5890

Agilent Intuvo

Photo Credit:
http://www.aimanalytical.com/5890.html
http://www.businesswire.com/news/home/20160830005184/en/Agilent-
Technologies-Introduces-Transformational-Technology-Gas-Chromatography
Traditional Methanizers

- 16+ parts
- 2-6 hour installation
Recent Advances: Jetanizer™

Traditional Methanizer

Jetanizer

16+ parts

1 part

Agilent

Shimadzu
Jetanizer™: Simple Installation

Traditional Methanizer | Jetanizer
---|---
2-6 hours | Installation time | 1-5 minutes
## Jetanizer™ vs. Methanizer

<table>
<thead>
<tr>
<th>Feature</th>
<th>Jetanizer™</th>
<th>Methanizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate CO and CO₂ Conversion</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>&lt;5 minute installation</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Sulfur Tolerant</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>No Extra Equipment Needed</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Non-Toxic</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Up-Front Cost</td>
<td>$595</td>
<td>&gt;$2,000</td>
</tr>
</tbody>
</table>

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Jetanizer™: CO₂ Analysis

1 mL sample loop
Jetanizer™: Hydrocarbon Matrix

Conventional FID Jet

1. Methane
2. Ethylene
3. Acetylene
4. Ethane
5. Propylene
6. Propane

Jetanizer™: Hydrocarbon Matrix

CO$_2$ in Confined Space


38,000 feet, in flight for 2 h
CO₂ in Carbonated Beverages

Flue Gas Analysis

1. Methane
2. CO$_2$

Jetanizer™: Formaldehyde

1. Air
2. Methane
3. CO₂
4. Ethane
5. Formaldehyde
6. Propane
7. Butane
8. Formaldehyde dimer
9. Pentane
10. Hexane

Polyarc® System: Universal Carbon Response

Microreactor Design and Stainless Steel 3D Printing + Expertise in Catalysis Design and Synthesis = First and Only Commercial 3D Printed Microreactor
## Polyarc® and Jetanizer™

<table>
<thead>
<tr>
<th>Feature</th>
<th>Polyarc® System</th>
<th>Jetanizer™</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal Response</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Resistant to Poisons</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Capillary Column Compatible</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Accurate CO and CO₂ Conversion</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Reduction in Calibration</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>
Questions?

Thank you!

ARC can be found at Booth #522.