Dynamic Imaging Principle
Microbial Growth Detection in Fuels

JM Canty International
Presentation Outline

Dynamic Imaging Principle

Image Retrieval – Hardware

Image Analysis – Software

Data Outputs

Sample Case Study
Vision Based Particle Analysis Basic Principle

JM Canty’s vision based technique works on the basic principle of presenting the fluid between a high intensity light source, and microscopic camera.

The captured images are then sent to Cantyvision Client Software for analysis, where the suspended particulate (water, microbials, gas bubbles etc.) is measured under a number of different parameters to provide size, shape and count data.

Identical optics between the lab and inline system ensures consistent results.
Image Retrieval - Hardware

- JM Canty’s vision based systems are made up of 3 critical components;
  - CCD Ethernet Camera
  - Flow Path between two Canty fused glass pieces
  - Canty High Intensity Light Source
Image Retrieval – Hardware – CCD Camera

Gigabit Ethernet technology for optimum image retrieval

1600 x 1200 Pixel Array configurable to 0.20µm per Pixel Resolution

1/100,000s Shutter Speed

Particle / Droplet Size to 0.7µm

Simple RJ45 Network Connection to Control PC

Sand in Water
Image Retrieval – Hardware – Fused Glass Flow Path

- Fusion of glass to metal – one piece construction
- Critical to our vision based technique
- Pressures to 600 BAR, Temp -200 to 300°C
Importance of fused glass technology

• Hermetically sealed one piece construction means no recesses or gaps where product can adhere to and start to build up
• Spray Ring option included as standard
• Adjustable Gap Size dependent on sample present
High flow rates inline require an increased shutter speed and so an increased amount of light to capture particulate in “freeze frame” in order to perform software analysis.

Flow speeds up to 2.75m/s (dependent on light transmission through fluid)

<table>
<thead>
<tr>
<th>Pipe Line Size</th>
<th>Max Flow Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1”</td>
<td>83 l/m</td>
</tr>
<tr>
<td>2”</td>
<td>335 l/m</td>
</tr>
<tr>
<td>3”</td>
<td>750 l/m</td>
</tr>
<tr>
<td>4”</td>
<td>1340 l/m</td>
</tr>
<tr>
<td>6”</td>
<td>3000 l/m</td>
</tr>
<tr>
<td>8”</td>
<td>5300 l/m</td>
</tr>
</tbody>
</table>
JM Canty’s Vision Based Technique

- Various systems depending on application retrieve live images from the process
  - Tru-Flow
  - Inflow
  - Particle Probe
Tru-Flow Portable / Lab System

- Lighting
- Camera
- Flow Gap

DIFFUSED HIGH INTENSITY COLLIMATED BACKLIGHTING

HIGH MAGNIFICATION OPTICS COMBINED WITH AN ETHERNET IMAGING SYSTEM, PROVIDE SUPERIOR RESULTS

PATENTED GAP CONTROL IS ACCOMPLISHED BY USING PRECISE VARIABLE THICKNESS GASKETS PROVIDING A UNIFORM THIN CURtain OF PRODUCT TO THE OPTICS AND BACK LIGHTING
Tru-Flow Portable / Lab System

Portable system that can be easily transported to different measurement points
The Inflow (pipelines up to 22”) works on the same principle as the Tru-Flow

- Lighting
- Camera
- Flow Gap
Image Analysis – Cantyvision Software – Operator Screen

Puts information and configuration in an easy to read format for ease of operator control

Graphical outputs of particle size distribution and concentration

Configurable calculation for client specific products
Case Study: Microbial Detection Studies

A strain of bacteria of varying cell density (\(10^2\) cells per ml to \(10^5\) per ml) were analysed utilising the dynamic imaging based technique.
Case Study: Microbial Detection Studies

Cell Density $10^4$ cells/ml

Cell Density $10^5$ cells/ml
Case Study: Microbial Detection Studies

Microbial Cell Density Measurements

- Canty Total Volume/250 frames
- Microbial Cell Density (Cells/ml)
Case Study: Preliminary Microbial Detection Studies
Detection and Differentiation of both Microbial Growth and Free Water

Microbial Detection

Droplet Detection
Summary

- Size measurement down to 0.7 microns
- Count and Size
- Real time measurement
- Visual verification
- Simultaneous detection of both microbial growth and free water
- Inline and Laboratory systems optically identically allowing for consistency between results
Questions & Answers

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