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Advanced Technology Associates is the Exclusive
Representative in Northern Ohio for
J. M. CANTY, INCORPORATED

NT VECTOR APPLICATION

**Water Quality – E. Coli Detection
On-line Particle Analysis**

SCOPE -- The J.M. Canty On-Line Microscope provides a real time analysis and view of the most difficult items to detect in water purity analysis. The system allows detection and analysis of water borne particles by inserting a process microscope directly into the water stream. The Canty equipment items to perform this purity analysis are introduced here.

BACKGROUND - This note details use of a Canty Microscope to inspect water for the presence of dangerous bacteria such as *E. coli*. This background is extracted from information published on the WEB by John C. Brown. *E. coli* is the abbreviated name of the bacterium in the Family *Enterobacteriaceae* named *Escherichia* (Genus) *coli* (Species). This is one of the many bacteria present in a normal adult intestinal tract. The presence of *E. coli* and other kinds of bacteria within our intestines is necessary for us to develop and operate properly, and for us to remain healthy - *E. coli*, along with other species of bacteria, provide us with many necessary vitamins for example. The bacteria make the vitamins, and we gladly absorb them. We pretty much depend upon *E. coli* in our intestines for our source of Vitamin K and B-complex vitamins.

There are different "strains" of bacteria within a given species. Some of these different strains of bacteria (there may be several within a given species) can be harmful to us. So, it is possible for us to acquire an individual strain of *E. coli* which mixes with the other *E. coli* in our intestines. The rare strain of *E. coli* that is getting a lot of "press" lately because it is indeed a bad bug, is *E. coli* O157:H7, a member of the EHEC - enterohemorrhagic *E. coli* group. Enterohemorrhagic means an intestinally-related organism which causes hemorrhaging - and therefore, loss of blood. The image shown as Figure 3 below is a picture of O157:H7 (compliments of David Graham, University of Illinois at Urbana/Champaign).

This virus's genetic information (genes) unfortunately (for us) contained information for the production of a toxin, called Shiga-like toxin (SLT), or is sometimes called, Vero toxin. Consequently, this strain of *E. coli*, and all of its progeny produce this toxin. The toxin is a protein which causes severe damage to intestinal epithelial cells (the cells that line the wall of the intestine). The damage is so severe that if we acquire this bacterial strain, not only do we lose water and salts, blood vessels are damaged, and bleeding occurs - lots of bleeding - hemorrhaging. This condition is particularly dangerous to small children - may be lethal - children are too small to tolerate much blood and fluid loss. Too, in some cases another syndrome is involved which is called hemolytic uremic syndrome (HUS), which is characterized by kidney failure and loss of red blood cells. Approximately 5% to 10% of little kids progress to this stage of disease - which is very dangerous for them. In severe cases, the disease can cause permanent kidney damage. So, *E. coli* O157:H7 is a dangerous organism, for sure.

FUNCTION -- The Process Microscope Camera (see attached data sheet 99A7739.doc) can be used to view the flowing process liquid and has the required magnification to display the bacteria cells. Figure 1 shows an image of yeast cells in a relatively dense fluid sample. The water inspection process will have a much lower cell count.

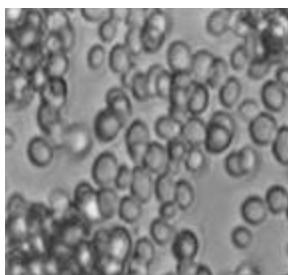


Figure 1 Yeast Cells imaged by Cauty microscope

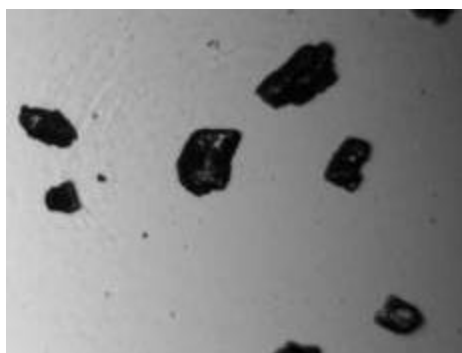


Figure 2 in-organic solids imaged by Cauty microscope

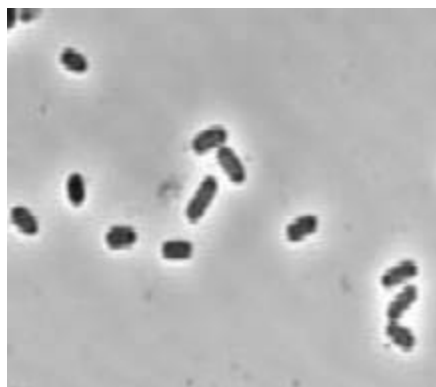


Figure 3 *E. coli* cells

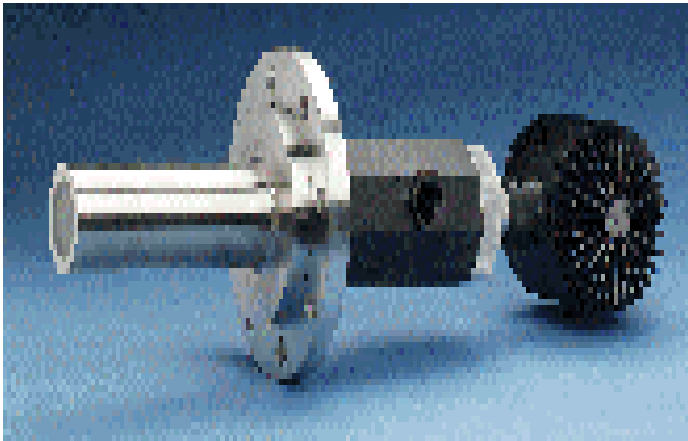
The Cauty camera video image is fed to the Cauty Vector for image analysis. The detected cells are analyzed for size and shape permitting the biological derived particles to be distinguished from in-organic material such as sand.

SUMMARY – The Cauty on-line microscope (data sheet # 99A7739) can be used as a sensor to verify water quality when mounted to view processed water flow. The Vision Analysis required is performed by the Vector NT System (data sheet # 99A8035), a computer system with a video digitizer running Cauty developed software. For lab applications, the Vertical Imaging Microscope (data sheet # 99A7744) offers a versatile sensor used with either the slide holder or flow cell.

CANTY

PROCESS TECHNOLOGY

PROCESS MICROSCOPE CAMERA SYSTEMS



PARTICLE SIZING

The Canty Process Microscope Camera is a high speed system that captures and displays live video images for blur-free, flicker-free pictures. The Process Microscope Camera features a unique lens that views particles as small as 1 micron, with optional zoom controls to widen the view angle to 1000 microns (additional size ranges through 10 in. are available - consult factory). Process Microscope Cameras are available with various weather proof, explosion proof and flame proof ratings.

VECTORTM SYSTEM

The VectorTM System interface, via coaxial cable or fiber optic video transmission, allows the Process Microscope Camera to interface with the Canty VectorTM System to perform one or more of the following:

- Two dimensional (2D) in-line particle analysis
- Surface roughness / defect detection
- Morphology CUTTM analysis

Various outputs can be provided by the VectorTM, including 4-20 mA, TCP/IP, particle distribution data tables, on-line user interface graphs and data recording. A remote modem interface allows full plant access and remote technical support to view and analyze the images and data.

IN-LINE , REAL-TIME PARTICLE SIZING

Canty systems provide an in-line, live video image of your process. Imagine how your process can benefit from a live video of your particles as they are growing. A Canty VectorTM System can provide immediate feedback on particle size, distribution, aspect ratio, etc without sampling. Your data can be immediately analyzed for maximum product yield and control.

FIBER OPTIC LIGHTING

To perform the high speed imaging required for microscopic analysis, a great deal of illumination is required. This high-powered lighting is accomplished by the Canty HYL80 fiber optic light. The Canty light is a cold light, adding no additional heat to the process. This prevents bake-on of the product, as well as product degradation. The HYL80 allows viewing and image capturing (down to one micron) at speeds up to 1/100,000 second.

FUSED GLASS TECHNOLOGY

The Process Microscope Camera System provides high pressure and high temperature viewing inside of a reactor, due to the fused glass to metal seal. Many models carry pressure ratings through 6000 PSI and temperatures through 2000° F. This is a true high pressure, hermetic seal of glass and metal. The fused glass is not subject to leakage and has extraordinarily high impact resistance. Our fused glass technology allows for maintenance-free sealing!

FEATURES

- Fused Glass, High Pressure / Temperature Seal From Process
- CCD Based High-Speed Imaging Device
- NEMA 4, Explosion proof / Flameproof Ratings are Available
- Manual or Remote Zoom Control Options
- Microscopic Lens Option - One Micron Range
- Coaxial Cable, Fiber Optic Video Output Options

SPECIFICATIONS

Cameras:	Shutter speeds - selectable from 1/60 sec. to 1/100,000 sec.
Video:	NTSC (U.S) or PAL (Europe) - industry standard. Can be recorded on any VCR.
Power:	115V or 230V options, 50/60 Hz.
Ratings:	Weather proof - NEMA 4, IP 66 Explosion proof (U.S.) Class I, Div 1, Groups B,C&D, Flame proof (Europe) EEx d IIC T6 models are available.
Wetted Mat'l.	SS or Hastelloy

APPLICATIONS

- Crystallizers
- Fermentation Applications – Optical Density/Cell Count
- Mining-Flotation Cells and Thickener Tanks
- Web Inspection

