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Sample Test Report
2001

Company: Major Detergent Manufacturer

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Sample Identity- The sample materials consist of 8 samples of household detergent product.

Purpose:

This report details the testing and results for the detergent product done in the Canty Lab on the Weatherproof Sizer. The data presented here has been obtained by using the improved Canty technology for whiteness evaluation and determination of the concentrations of colored materials present in the samples provided. The first part of this report details the color intensity testing on samples 1 through 6 for whiteness evaluation while the second part of this report details the color speck inspection of samples 7 and 8 used to distinguish blue particles from green particles.

Lab Setup:

The Weatherproof Sizer was used to present the particles to the imaging sensor for capture and subsequent analysis. The Canty system is vision based and self-contained including illumination components. Video signal is fed to the Canty Vector where our software performs the appropriate analysis. Vector contains several imaging tools and techniques in the software that allow a full analysis of the particle images. The graphical images presented in this report show a 3 cm by 2 cm view of the particles on the feeder tray.

Calibration:

The sample flow rates were kept constant for all samples. Lighting was regulated using a constant voltage power supply.

Results and Discussion:

Whiteness Evaluation

Figure 1-3 show typical test images for samples 1, 2 and 6 respectively. The three screen captures were taken under identical lighting conditions and differences in the colors of the images as a whole are detectable to the eye. Measured color characteristics of the samples are listed below each figure. These include the images' RGB color parameters as well as their YUV color parameters. The total color of an image is the vector sum of either of these sets of parameters when the proper coordinate system is used. Accordingly, in color space, a total "Color parameter" can be calculated for each sample. This value is also listed with each image.

Figure 1 has the lowest color parameter. This indicates that this is mathematically the whitest of the three images shown. Figure 2 visually appears to have a slight yellow tint and has a slightly higher distance from white indicated by its color parameter. Figure 3 appears to contain a substantial degree of blue-gray shading and has a significantly larger color parameter.

In order to obtain an average color parameter for each of the six samples provided, approximately 1100 images were taken for each trial. Three trials were conducted for each sample under identical conditions. Table 1 lists the trials in order from the whitest to the most colored along with the color parameter obtained in each trial. The results indicate that sample 1 is mathematically the whitest of the six samples provided while sample 6 is the most colored. This is consistent with a visual inspection of the samples.

The ordering of the trials in table 1 is based on a mathematical model of color that takes into account both intensity and color where the brightest white would occur at a very high intensity (Y = 255) and a very low value of color (U,V = 0,0). Deviations from the origin in the UV plane can be made in any direction and result in different colors. A deviation of one unit from white in one direction would result in a blue tint while a deviation of one unit from white in the opposite direction would result in a yellow tint. Two samples with these color characteristics would be mathematically equivalent in "whiteness" but could be perceived by the consumer as different. In these cases, rather than evaluation of whiteness itself, color evaluation parameters based on the raw YUV or RGB data that reflect the perception of the intended market would need to be developed.

Figure 1: Test Image of Sample 1.

RGB = (165.2, 142.5, 136.1), YUV = (148.8, -6.2, 14.5)
Color Parameter = 186.7

Figure 2: Test Image of Sample 2.

RGB = (164.0, 141.5, 133.4), YUV = (147.5, -6.5, 14.5)
Color Parameter = 189.6

Figure 3: Test Image of Sample 6.

RGB = (153.6, 135.7, 132.6), YUV = (140.5, -3.9, 11)
Color Parameter = 198.7

Table 1: Sample Trials Ordered from Whitest to Most Colored.

1c	1b	1a	2a	2c	2b	4c	4b	4a
185.9	186.3	187.2	189.3	189.5	189.8	190.4	190.8	191.3

5b	5a	5c	3c	3a	3b	6a	6b	6c
191.4	191.5	191.5	191.9	192.1	192.2	199.8	200.1	200.2

Color Speck Inspection

Figure 4 shows an image of sample 8. Figures 5 and 6 present the digitized images of sample 8 after the color detection software has processed the image in figure 4 for blue and green specks respectively. The digitized images show that when the blue detection parameters are used, the majority of the blue particles are identified and when green detection parameters are implemented, the green particles make up the majority of the detected areas. As the wavelengths of light which produce the colors blue and green are continuous, it is expected that there might be some particles with both blue and green detection regions. This can occur due to operator judgments with respect to where to draw the line between blue and green or due to the fact that some particles do have both colors present in different regions. Figures 5 and 6 show some of this effect in that both blue and green are often detected in many of the particles.

Three trials of 250 images were conducted for sample 7 and two trials of 250 images were conducted for sample 8. Table 2 summarizes the percentage of colored areas detected in

the images. The table shows that a small amount of green area is detected in sample 7. There is, however, a tenfold increase in the amount of green area detected when sample 8 is analyzed. The percentage of blue area detected remains fairly constant at around 5-6 % of the total image area.

The area of the color detected can be correlated to the amount of blue and/or green particles that are in a sample even though there is a small amount of overlap in the colors. This is because the Canty system can process material on a continuous basis and yield consistent results for a sample once it has been calibrated to inspect for the desired colors.

Figure 4: Image of Sample 8 (blue and green specks).

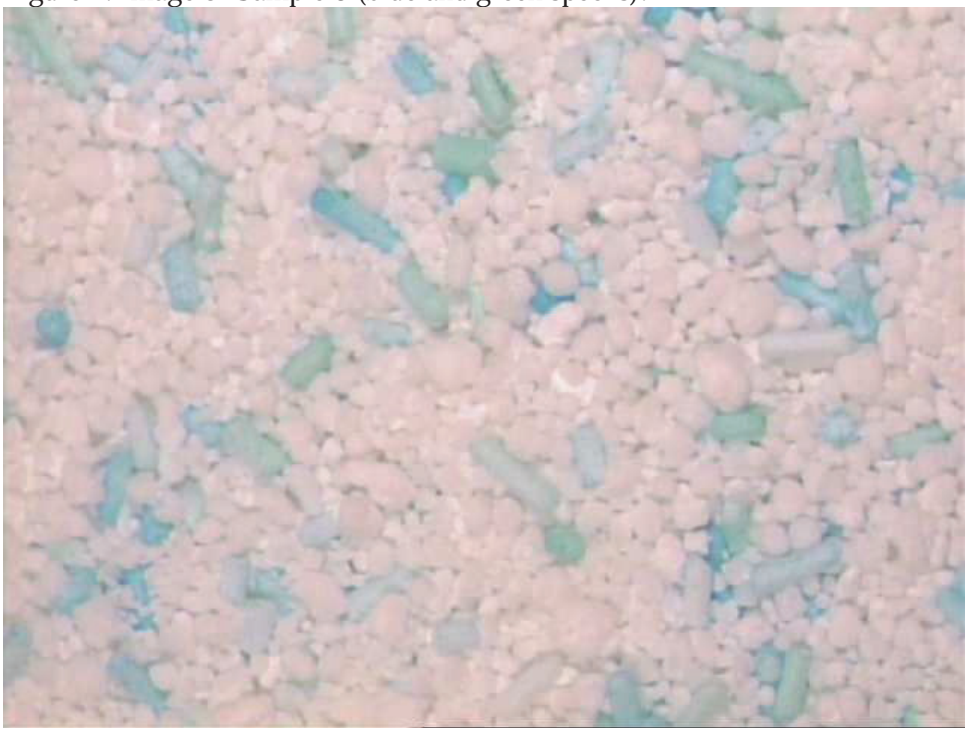

Figure 5: Digitized Image, Blue Detection

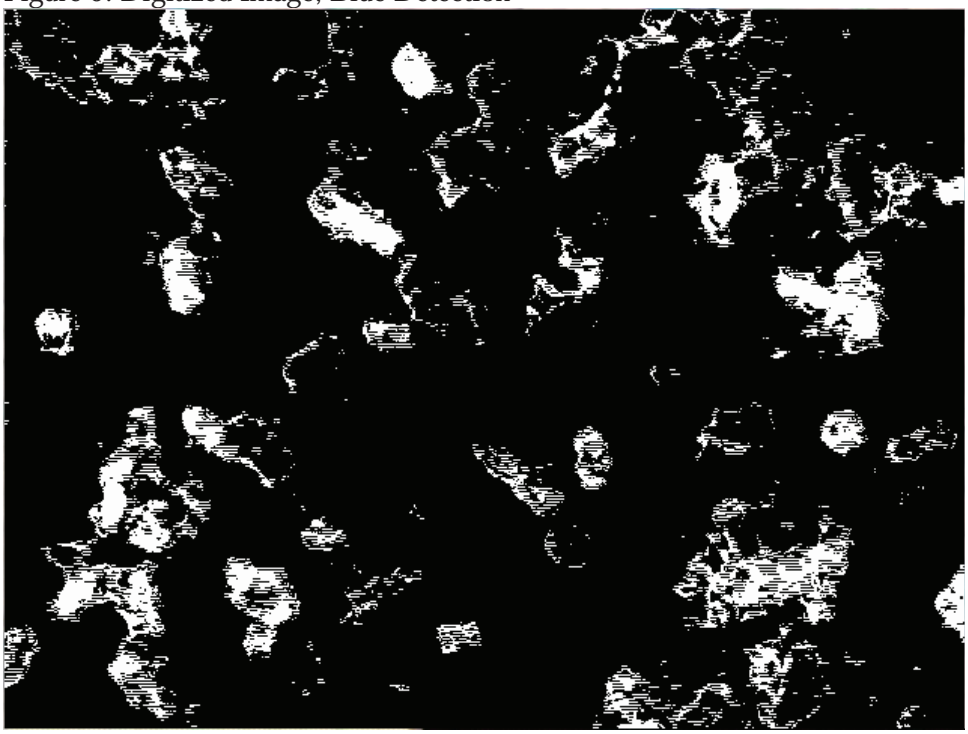

Figure 6: Digitized Image, Green Detection

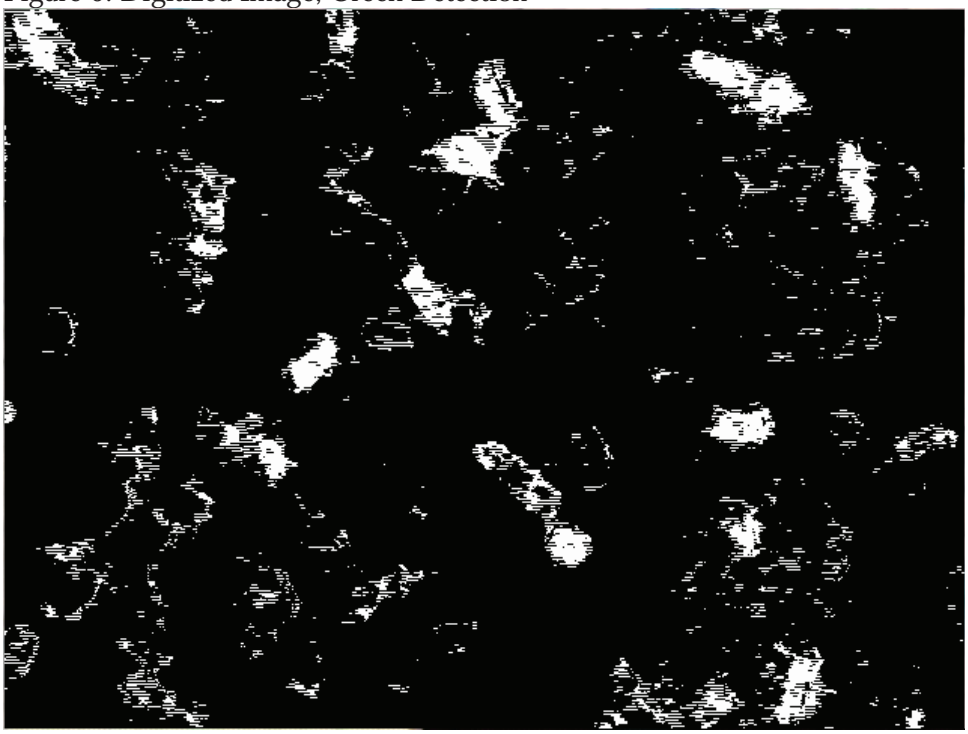

Table 2 : Percentage of Colored Particles Detected.

	Sample 7a	Sample 7b	Sample 7c	Sample 8a	Sample 8b
Blue % of Area	6.65	4.56	5.34	6.28	6.88
Green % of Area	0.15	0.11	0.14	1.57	1.56

Conclusions:

The Canty system will provide a consistent measurement of whiteness and reproducible results on the products cited in this report. With information based on the sensory perception of the consumer, it can be calibrated so that the whiteness measured will relate to desired product color. It can also distinguish between the blue and green particles in the samples provided and provides data that can be correlated to colored particle concentration. The system should be usable both as an analytical tool for QC/QA and as an in-stream analyzer and in that regard can provide measurement results in a matter of minutes on a continual basis.

Ordering Information:

The following information provides ordering guidance. The data from this test report can be used to aid in installation and setup of a CantyVision System.

The following Documents are attached:

Document Description	Document ID #
VECTOR NT SYSTEM	99A8035
SYSTEM INTRODUCTION	98A7560
IN-LINE COLOR ANALYSIS	98A7565
BLACK SPEC DETECTION	98A7568
SOLID SIZER	99A7753