CHEMetrics® Hydrogen Peroxide Self-filling Ampoules vs. Test Strips

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Application Note

In the Food and Beverage industry, plant operators on packaging lines routinely monitor sterilization solution residuals in Extended Shelf-Life (ESL) and aseptic packaging applications. The product cartons used to package juice, milk and other dairy products are sprayed with hydrogen peroxide to pre-sterilize them, then heated to remove the hydrogen peroxide. The use of ESL and aseptic processes increases product shelf-life and reduces or eliminates the need for refrigeration or addition of preservatives.

Small amounts of food grade hydrogen peroxide are generally recognized as safe for consumption. However, it is widely understood that appropriate measures should be taken to remove residual peroxide from finished products, as peroxide residual may cause a detrimental effect on nutritional value and loss of quality of the product. The US FDA specifies a limit on hydrogen peroxide residual in packaging of no more than 0.5 parts per million (ppm)[1]. This peroxide level is often referenced globally as an acceptable residual limit.

Plant operators monitor sterilization residuals by filling representative beverage containers to the normal fill level with distilled water rather than product, then analyzing the distilled water rinsate for hydrogen peroxide. Analytical tools for monitoring residuals include CHEMetrics hydrogen peroxide self-filling ampoules and hydrogen peroxide test strips.

Summary of Evaluation

In this study, comparison testing was performed between CHEMetrics® visual CHEMets® Test Kit, Cat. No. K-5510, CHEMetrics® photometric Vacu-vials® Test Kit, Cat. No. K-5543, and EMD Millipore's MQuant™ Test Strips (Part No. 110011).

The CHEMetrics® self-filling ampoules and the MQuant™ test strips were evaluated in triplicate at four hydrogen peroxide concentrations: 0, 0.15, 0.25, and 0.50 ppm. Standards were prepared in distilled water. For each replicate, the same aliquot was tested with the test strip and both types of self-filling ampoules.

Color standard increments with K-5510 CHEMets® Kit: 0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.8 ppm
Scale increments with the MQuant™ Test Strips: 0, 0.5, 2, 5, 10, and 25 ppm
Results for the K-5543 Vacu-vials® Kit were obtained with two CHEMetrics® factory calibrated (direct read) photometers, I-2016 Single Analyte Photometer and V-2000 Multi-Analyte Photometer. Results were obtained in 0.01 ppm increments.

Results

The CHEMetrics® K-5510 visual CHEMets kit was used to easily distinguish concentrations in 0.05 ppm increments in the 0-0.5 ppm range. Picture 1 displays color development at 0.5 ppm. Test results obtained at all check points were exactly equivalent to the actual standard concentration.

Similarly, average results obtained with CHEMetrics® K-5543 photometric Vacu-vials kit were within ± 0.02 ppm of the standard concentration (Table 1).

MQuant™ Test Strips were able to distinguish between 0 ppm and 0.5 ppm hydrogen peroxide. Color intensity with the test strips at 0.25 ppm, though pale, was estimated to fall halfway between the 0 and 0.5 ppm scale increments. At 0.15 ppm, color development with the test strip was barely perceptible. Picture 2 displays the color intensity observed with the MQuant™ Test Strips during testing with all standards. At best, the test strips demonstrated a positive test result at 0.15 ppm.

Conclusion

Precise, accurate and repeatable results are obtained with CHEMetrics® Hydrogen Peroxide Test Kits in the 0-0.5 ppm test range that is critical to routine peroxide residual monitoring in ESL and aseptic packaging applications. The simple snap-and-read technology provides results within 1 minute. The CHEMetrics test kits should be stored in the dark at room temperature.

The MQuant™ Test Strips, although easy to use, are not designed to accurately distinguish results at various sub-ppm levels of peroxide. **Due to the broad scale increments and the very pale reaction color below 2 ppm, the test strips should be used only as a presence-absence test in the 0-0.5 ppm range.** The test strips require refrigeration as well as humidity and light exposure control.

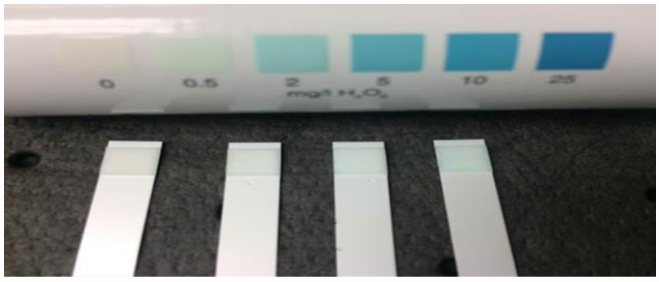
Table 1: Average Hydrogen Peroxide Test Results

CHEMetrics® Hydrogen Peroxide Self-filling Ampoules vs. Test Strips

Peroxide Conc., ppm	CHEMetrics K-5510, ppm	CHEMetrics K-5543, ppm	MQuant™ Test Strips, ppm
0	0	0.00	0
0.15	0.15	0.13	> 0
0.25	0.25	0.24	0.25
0.50	0.50	0.48	0.5

Picture 1: CHEMetrics® Color Comparator at 0.5 ppm

Picture 2: MQuant™ Test Strips Color Intensity



0 ppm 0.15 ppm 0.25 ppm 0.50 ppm

[1]*Code of Federal Register, Title 21, Part 178, Section 178.1005(d)*