ATP Hygiene Monitoring Systems: Hygiena's UltraSnap® Outperforms Tianlong's Quickswab for Food Residue Detection

Introduction

The Importance of ATP Monitoring Systems

ATP testing is not meant to replace microbial testing. However, ATP tests provide valuable feedback about cleaning methods in seconds, compared to hours or days needed for microbial enumeration tests.

ATP monitoring is a simple, rapid, quantitative testing method for verifying the hygienic status of surfaces on processing equipment and other environments in a wide range of industries. Adenosine triphosphate (ATP) is the universal energy molecule found in all animal, plant, bacterial, yeast and mold cells, essentially functioning as an indicator of cleanliness. After visible food debris and organic matter are removed from surfaces, ATP test systems can be used to detect ATP from extremely small amounts of residue, including any microorganisms.

Lower ATP readings signify thorough cleaning and lower risk of microbial contamination. Using ATP measurements, organizations can objectively determine if a surface has been cleaned properly and is safe for use or if corrective action, such as re-cleaning, is required.

Hygiena's ATP Monitoring Systems

Hygiena's ATP monitoring systems include a handheld luminometer and an easy-to-use testing device. Our luminometers (e.g., EnSURE® Touch) detect bioluminescence that is dependent on the amount of ATP in a sample. Testing devices with various sampling tips and luciferase assay reagents are available for water sampling (AquaSnap®) and surface swabbing (UltraSnap® or SuperSnap®). This study focuses on UltraSnap, a pen-sized device that contains a sampling swab and liquid-stable reagents. After sample collection, the UltraSnap device is activated and inserted into the luminometer for measurement.

Comparison of ATP Monitoring Systems: Hygiena vs. Tianlong

The choice of ATP testing systems for routine monitoring is important because the sensitivity of ATP detection from residual organic matter can vary by system. In the comparison studies described below, we tested the performance of the Hygiena and Tianlong ATP monitoring systems using purified ATP and food samples.

Methods

Purified ATP Samples

A stock solution of ATP was serially diluted from 1,000 nM down to 0.1 nM. Samples (10 µL) contained 0 to 200 fmoles of ATP.

Testing was done using either Hygiena's EnSURE Touch luminometer with UltraSnap or Tianlong's Biolum III with Quickswabs, as instructed by the manufacturers. Both luminometers measure the light generated from the testing devices and report the results in relative light units (RLUs).

Milk Samples

Raw milk was either undiluted or serially diluted with sterile water from 1:10 to 1:100,000. Meat (ground beef) was homogenized in a Stomacher bag with sterile water and was either undiluted or serially diluted with sterile water from 1:10 to 1:100,000. Each sample (including a sterile water blank) was spread evenly onto a stainless steel surface (100 cm^2) and allowed to dry before testing. Tests were run in triplicate.

Testing was done using either Hygiena's luminometer with UltraSnap or Tianlong's Biolum III with Quickswabs, as instructed by the manufacturers.

Results

Serial dilutions of ATP were prepared and used to determine the absolute limit of detection (LOD) (Table 1). Testing was performed using both the Hygiena and Tianlong systems. Hygiena's system can detect approximately 4.5X lower levels of ATP contamination.

Table 1. Comparison of Purified ATP Sample Measurements.

ATP Amount (fmoles)	Hygiena UltraSnap (RLUs)	Tianlong Quickswab (RLUs)
200	386.0	157.3
100	209.3	100.0
25	36.0	30.3
10	6.3	7.6
5	2.3	1.0
1	1.6	0.0
0	0.4	0.8
Absolute LOD*	**0.16**	**0.65**

* LOD = (mean RLU_{blank} + 3.3 standard deviations)/slope of the response.

In the presence of food residues, the RLU output for the Tianlong system was much lower than that of the Hygiena system, which resulted in reduced performance of the Tianlong tests, especially at low ATP concentrations (Tables 2 and 3). The raw milk and meat studies show that Hygiena's UltraSnap can detect lower amounts of diluted food residues and is 10 times more sensitive than Tianlong's Quickswab.

Table 2. Comparison of ATP Detection Using Milk Residue.

Raw Milk Dilutions	Hygiena UltraSnap* (RLUs)	Tianlong Quickswab (RLUs)	Corresponding Colony Forming Units (CFUs) for Hygiena System
Undiluted	2,426	330	254
1:10	3,622	450	25
1:100	389	24	2.5
1:1,000	29	2	0
1:10,000	0	1	0
1:100,000	0	2	0
Blank	0	2	0

* While this study was originally done using the SystemSURE *Plus*® luminometer, we are showing the equivalent RLUs users can expect to see with the newer EnSURE® Touch luminometer based on comparison studies of the two instruments [1].

Table 3. Comparison of ATP Detection Using Meat Residue.

Meat Homogenate Dilutions	Hygiena UltraSnap* (RLUs)	Tianlong Quickswab (RLUs)	Corresponding Colony Forming Units (CFUs) for Hygiena System
Undiluted	10,805	881	550,000
1:10	814	24	55,000
1:100	60	3	5,500
1:1,000	5	1	550
1:10,000	0	1	55
1:100,000	0	0	5
Blank	0	1	0

* While this study was originally done using the SystemSURE *Plus* luminometer, we are showing the equivalent RLUs users can expect to see with the newer EnSURE Touch luminometer based on comparison studies [1].

Discussion and Conclusions

Not all ATP monitoring systems are equivalent. This study summary shows how Hygiena® luminometers and UltraSnap devices outperform another ATP monitoring system from Tianlong® (Biolum III luminometer and Quickswab devices).

The study using purified ATP showed that Tianlong's system is not as sensitive as Hygiena's for detecting low-level contamination (ATP). The second study was designed to mimic real-world samples for a more practical comparison of the Hygiena and Tianlong ATP monitoring systems. When testing dilutions of milk and meat samples, the measurements from Hygiena's UltraSnap devices were much higher than those from Tianlong's Quickswabs, which suggests that the Tianlong system is not optimized for food residues.

As presented in this technical bulletin, Hygiena luminometers paired with UltraSnap devices perform better than Tianlong's Biolum III – Quickswab system. In addition, UltraSnap devices are certified by the AOAC Research Institute as a *Performance Tested Method*℠ (License no. 101803) when using the EnSURE Touch luminometer.

Although SystemSURE *Plus* luminometers are robust, Hygiena recommends using the EnSURE Touch luminometer paired with our SureTrend® software, a cloud-based platform for data analysis and trending. Together, they form a system that integrates data from ATP, rapid indicator, allergen and PCR tests. This system is designed to adapt to your workplace, providing the data you need for complex multi-location supply chain monitoring, audit and risk management and recall prevention.

References

1. Hygiena Technical Bulletin. *Sensitivity Comparison Between EnSURE Touch, EnSURE & SystemSURE* Plus *Luminometers*. Available at www.hygiena.com/documents.