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WHITE PAPER

Hygiene Verification - Analysing an alternative approach to ATP

Hygiene Verification - Analysing an alternative approach to ATP

Introduction

Effective hygiene monitoring is critical to food safety and compliance, and ATP testing is widely used for this purpose.

This white paper examines an emerging testing method that offers an alternative to traditional ATP assays, drawing on comparative research, real-word case studies, and expert insights.

It outlines the principles of ATP testing and what it measures, before evaluating the strengths and limitations of ATP-based hygiene monitoring alongside the alternative approach offered by the A3 system.

The result is a clear, evidence-based guide to improving cleaning validation and minimising hygiene risks at your food production site.

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BRCGS Global Standard Food Safety, Issue 9

Issue 9 of the BRCGS Global Standard for Food Safety underscores the critical importance of hygiene monitoring through multiple clauses focused on the cleanliness and hygienic condition of premises and equipment.

Clause 4.11.1 provides a clear distillation of this message, but despite its significance, is also one of the most common sources of non-conformities. This highlights the need for sites to strengthen both their cleaning procedures and validation methods.

> "Where cleaning procedures are part of a defined prerequisite plan to control the risk of a specific hazard, the cleaning and disinfection procedures and their frequency shall be validated."
> Clause 4.11.1

Clause 4.11.3 is equally important, as it directly addresses the validation of cleaning procedures and provides examples of suitable testing methods, including bioluminescence techniques such as standard ATP tests and the A3 system.

> "Premises and equipment shall be maintained in a clean and hygienic condition."
> Clause 4.11.3

What is ATP and why does it matter?

Adenosine triphosphate (ATP) is a molecule found in all living cells. For this reason, ATP testing is widely used in food and beverage production to quickly assess surface cleanliness and verify the effectiveness of cleaning procedures.

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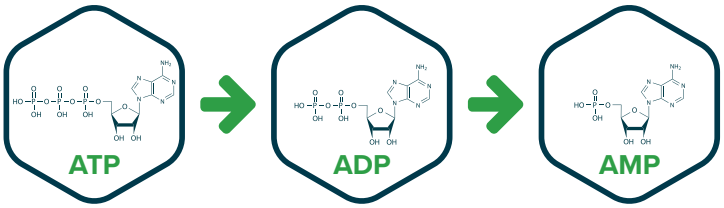
What are the limitations of standard ATP testing?

During common processes such as cooking, heating, and fermentation, ATP degrades to adenosine diphosphate (ADP) and adenosine monophosphate (AMP). Standard ATP tests only detect ATP and do not measure these breakdown products.

Because of this, a surface may pass an ATP test even when organic residue remains. This residue has the potential to support bacterial regrowth, increasing hygiene risks and ultimately compromising food safety.



How does the A3 system differ from standard ATP tests?

A3 tests are conducted in a similar manner to standard ATP-only tests, consisting of a handheld unit and swab.

However, the results of the A3 system can differ significantly from those of standard ATP tests because A3 technology detects all forms of organic residue: ATP, ADP and AMP. This broader detection gives the A3 system greater sensitivity to biological contamination, including protein residues.

In the context of hygiene and cleaning verification, the A3 system provides a more reliable indication of cleaning effectiveness and overall hygiene standards than ATP-only tests.

Comparison of a standard ATP assay with the A3 system when testing the same surfaces.

Both methods report results in Relative Light Units (RLU), a unit of measurement used to quantify the amount of light produced by a bioluminescent chemical reaction. Higher RLU values correspond to greater levels of organic residue.

In this study, the A3 system consistently detected higher levels of organic residue because it measures ATP, ADP, and AMP, whereas standard ATP tests measure only ATP. This distinction is particularly relevant for foods with low ATP levels, such as raw chicken, sausage, and beer.

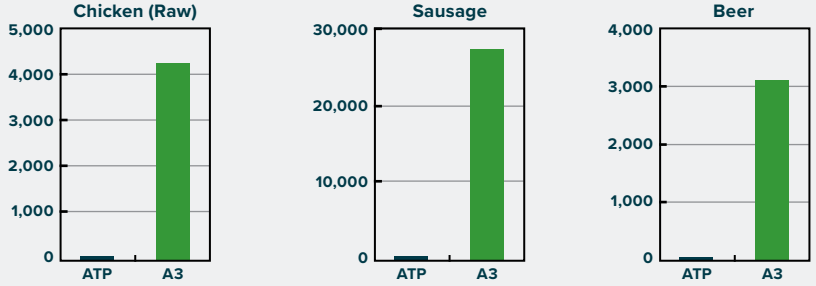


Figure 1. *Comparative study conducted by Kikkoman Biochemifa, the world's largest manufacturer of soy sauce and the developer of the LuciPac A3 Hygiene Monitoring System.*

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The A3 system and Cleaning Validation

ATP degrades at a more rapid rate when exposed to heat and certain cleaning chemicals. This is an important consideration in cleaning validation.

If the ATP on a surface degrades to ADP and AMP during the cleaning process, an ATP-only test could indicate the surface is clean, even though organic residue remains and could serve as a potential breeding ground for bacteria.

ATP, ADP, and AMP levels throughout the cleaning process.

After a water rinse, ATP falls below the pass threshold, but elevated ATP and AMP levels indicate residual organic matter. Hot water and a first detergent wash reduce ATP further, yet some organic residue remains. Only a second detergent wash brings all indicators to levels considered safe.

This study highlights that ATP-only tests can produce pass results even when organic residue remains and additional cleaning is required. Measuring ATP, ADP, and AMP together provides a more complete view of cleaning effectiveness.

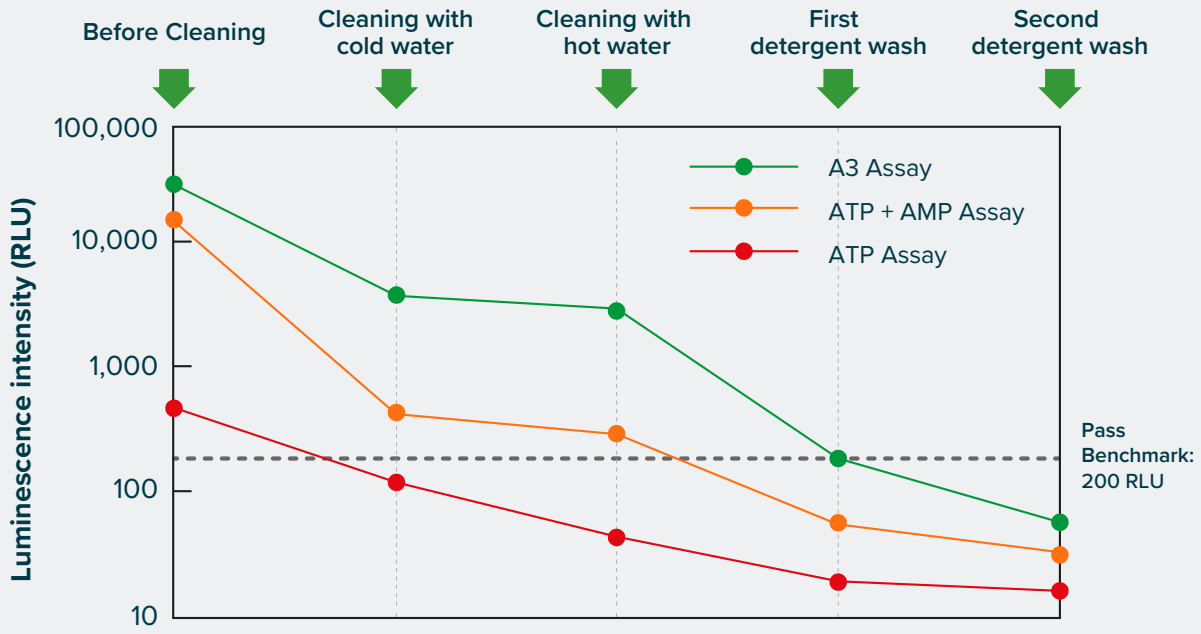

Figure 2. *Comparative study conducted by Kikkoman Biochemifa.*

AOAC® Performance Tested Methods℠ Program

The A3 System (Lucipac A3 Surface Meter) has been evaluated by the **AOAC® Performance Tested Methods℠** Program and was found to perform to the manufacturer's specifications. The two laboratories that independently carried out this testing were the NSF International and Q Laboratories.

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Case Studies

Ed Campion,
Hygiene Transformation Project Manager at Weetabix

Ed Campion, Hygiene Transformation Project Manager at Weetabix, worked with Klipspringer to conduct an on-site validation study. The study found that ATP testing was often inconsistent, while the A3 system provided reliable results aligned with visual checks and microbiological tests.

Benefits of switching to the A3 system:

- Reduced need for repeat swabbing
- Significant savings in time and resources
- Greater management confidence in data accuracy and hygiene practices

"The A3 system highlighted where teams weren't cleaning effectively. This led to a review of how teams were cleaning and the instructions they were receiving."

Nigel Church, Hygiene Manager at McCain Foods, approached Klipspringer with a key challenge: ATP-only tests were indicating surfaces were clean even when visual inspections showed otherwise. The A3 system addressed these inconsistencies, providing reliable data that allowed Nigel and his team to make informed updates to their cleaning procedures.

Benefits of switching to the A3 system:

- Increased swabbing reliability
- Reduced allergen swabbing requirements and overall costs
- Elimination of incorrect pass results
- Small unit, fast set-up, and quick results

"We're finding it reliable, we're finding it useful, and we're finding the machine really easy to use."

Nigel Church,
Hygiene Manager at McCain Foods

Read the complete case studies at klipspringer.com/case-studies

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The A3 system and allergen testing

Like standard ATP tests, the A3 system cannot identify specific allergens. Unlike ATP-only methods, it detects all forms of organic residue by measuring ATP, ADP, and AMP.

This distinction matters because many allergenic residues contain little or no ATP, meaning they could be missed by ATP-only testing.

While the A3 system does not confirm the presence or type of allergen, it provides greater confidence that residues associated with allergen contamination have been removed. It also helps to inform decisions on cleaning effectiveness and the need for allergen-specific testing.

Comparison of standard ATP assay results with those obtained using the A3 system.

Test surfaces were contaminated with allergens including peanuts, sesame, and raw egg, which typically exhibit low ATP levels but elevated levels of ADP and AMP.

Similar to Figure 1, all three tests demonstrate that the A3 system more effectively detects the presence of allergens when compared with ATP testing alone.

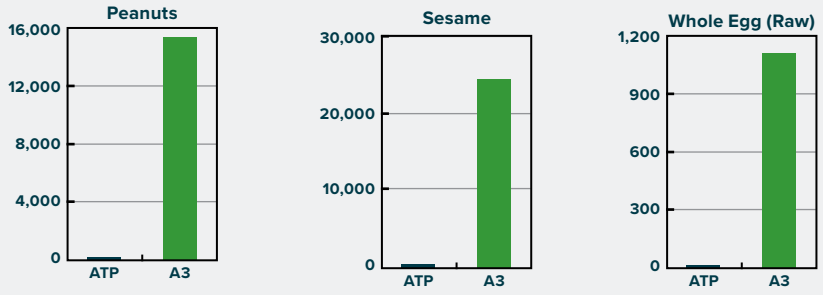

Figure 3. *Comparative study conducted by Kikkoman Biochemifa.*

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The A3 system and protein swabs

Although the A3 system is not designed to identify specific allergens, it can support allergen control programmes. Many sites, for example, use the A3 system to address key limitations of protein swabs.

Unlike protein swabs, the A3 system measures total organic residue rather than protein alone. This allows it to produce reliable, quantitative results, even after proteins have been denatured by heat, detergents, or chemical cleaning agents.

Comparison of the A3 system and protein swabs on stainless steel surfaces contaminated with salmon and chicken.

Both methods were performed four times: before washing, after a cold rinse, after a hot rinse, and after detergent cleaning. The protein swab produced a “pass” result after the cold rinse, even though organic residue was still present. In contrast, the A3 system only indicated a “pass” result once the surfaces had been thoroughly cleaned.

Testing Method	Surface contaminant used	Results before washing	Results after rinse with cold water (15 seconds)	Results after rinse with hot water (50°C, 15 seconds)	Results after clean with hygiene equipment and detergent, plus final rinse
A3	**Salmon**	Positive	Positive	Positive	Negative
	Chicken	Positive	Positive	Positive	Negative
Protein Swabs	**Salmon**	Positive	False negative	False negative	Negative
	Chicken	Positive	Inconclusive results	False negative	Negative

Key: **Positive:** Residue is present and detected
False negative: Residue is present, but test has failed to detect it
Negative: Residue removed, so a negative result is correct

Figure 4. *Comparative tests carried out by Saito and Bakke for Kikkoman Biochemifa.*

Comparative study of the sensitivity of the A3 system and protein swabs in detecting allergenic food products.

Results are divided into three categories: foods where the A3 system showed heightened sensitivity, foods where A3 and protein swabs had comparable sensitivity, and foods where protein swabs demonstrated higher sensitivity.

A3	A3 & Protein Swabs	Protein
Canned tuna, mackerel (raw), salmon (raw), shrimp, crab, yogurt, cream cheese, chicken (raw), pork (raw), beef (raw), abalone, squid, salmon roe, peanuts, soybean, bread, beer, almond, hazelnut, cashew, mustard, sesame, matsutake mushroom, coconut milk, celery, tomato, orange, kiwi fruit, banana, peach, apple, yam, walnut, and buckwheat.	Milk, ice cream, whole egg and wheat flour (boiled).	Gelatin

Figure 5. *Comparative study conducted by Saito and Bakke for Kikkoman Biochemifa.*

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What are the next steps?

1. Engage relevant stakeholders to confirm they are open to reviewing your current hygiene monitoring process.
2. Connect with Klipspringer to discuss your existing processes and how the A3 system could enhance them.
3. Collaborate on a supported study comparing A3 results with current on-site methods, such as standard ATP tests, visual inspections, and microbiological testing.
4. Klipspringer's Technical Team will help to establish suitable A3 benchmarks and provide supporting documents that can be shared with auditors or customers.
5. Roll out the A3 system with support from Klipspringer, including resources to assist with team training.

Radek Tameczka
A3 Specialist

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Led by Klipspringer's A3 specialist, Radek Tameczka, our Technical Team is available to help establish appropriate A3 testing benchmarks, provide supporting documentation, and offer resources to assist with team training.

If you have any questions or wish to discuss the specific requirements of your site, contact us a**t 01473 461 800** or **sales@klipspringer.com**

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