The complementary work of ATP and pathogen testing in environmental monitoring

Ever wondered how clean your food production facility really is? It's easy to give surfaces a once-over with the naked eye, but it takes much more to know they're free from harmful bacteria and other contaminants. That's where environmental monitoring comes in. NEMIS Technologies colleagues explain more…

METHODS SUCH AS ATP and pathogen analysis are important techniques used in environmental monitoring for food safety. They serve different purposes and provide complementary information about the cleanliness and safety of food processing and handling environments.

ATP analysis

One of the most reliable measures of surface cleanness is the test of the amount of ATP present on a surface. ATP is an energy carrier molecule found in all living cells, including bacteria. Thus, ATP analysis is often used as a rapid and qualitative indicator of overall cleanliness. It doesn't specifically identify the types of microorganisms but detects the presence of organic material, including living and non-living sources. It provides immediate feedback on the cleanliness of surfaces, enabling corrective actions to be taken promptly.

Pathogen analysis

One issue, however, is that ATP analysis doesn't distinguish between presence of organic matter, harmful pathogens, and non-pathogenic microorganisms.

Pathogen analysis is therefore a crucial process in providing the necessary level of food safety. It can be done by direct detection of harmful pathogens, such as *Listeria monocytogenes, Salmonella* spp. or STEC. Alternatively, indicator organisms can be targeted, such as *Listeria spp., Salmonella* Risk group (check out our newest N-Light™ *Salmonella* Risk test) or *E. coli*. This information is crucial for assessing the risk of contamination and potential health hazards, and for taking informed corrective and preventative actions.

However, there's one little hiccup – pathogen testing typically takes longer than simple ATP analysis. The time required for microorganism detection depends on the specific method used, but can span from a few hours to many days. Time to Results (TTR) is an extremely important factor for all food manufacturers, yet pathogen analysis almost never provides immediate feedback for corrective actions.

Do low ATP results tell us all about living bacteria?

ATP is often used to indicate cleanliness and hygiene because it is present in all living cells, including bacteria. The idea behind using

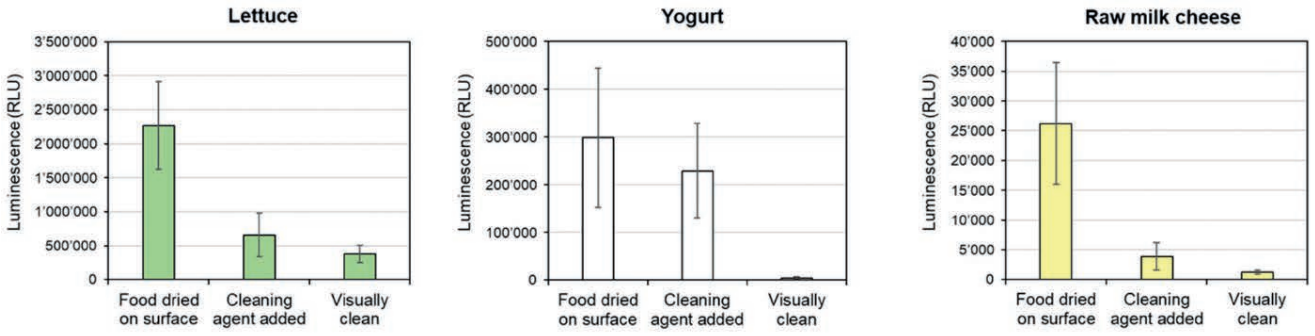

Figure 1: Results of the N-Light™ ATP test after: 1) spreading various food matrixes on steel surfaces, 2) addition of the cleaning agent, and 3) complete cleaning of the surface.

ATP as a measure of cleanliness is that when surfaces are properly cleaned and sanitised, the organic residues (which contain ATP) left behind by bacteria and other microorganisms are removed. Low ATP levels on surfaces are generally associated with effective cleaning practices. Therefore, in order to provide useful information about surface cleanliness, ATP tests should have a low limit of detection and should generate high luminescence signal, even at very low amount of ATP.

ATP levels vs number of bacteria

The ATP amount, however, should not be treated as an ultimate indicator for the absence of bacteria, including harmful pathogens.

The amount of ATP produced by a single bacterium is orders of magnitude lower than the limit of detection of even the most sensitive ATP tests. In practice, around 1,000 bacteria produce enough ATP to be detected by standard ATP tests based on luciferin/luciferase technology. This means that when the number of bacteria in the sample is less than 1,000 it very often goes unnoticed in a typical ATP test.

On top of that, stressors such as cleaning chemicals, UV light, or extreme temperatures influence the metabolic activity of bacteria. This can lead to a temporary decrease in ATP production. Stressed pathogens might reduce metabolic activity, which could result in lower ATP levels on surfaces. However, it is crucial to understand that this reduction in ATP levels does not necessarily mean that these pathogens are dead or eliminated. They might recover and become viable once conditions improve.

Both ATP and pathogen testing come with their own advantages and use cases. Thus, to achieve a comprehensive assessment of food safety, combining ATP analysis with targeted pathogen testing is our way at NEMIS to offer the most powerful tool to tackle food safety risks.

Conclusion – ATP goes hand in hand with pathogen testing

Keeping the overall safety of a food factory is a demanding and complex task. Every factory is different and testing processes and methods should be evaluated separately. Factors such as prevalence of different pathogenic bacteria, expected accuracy of result, time to result, and sampling frequency should be evaluated for the targeted environment. Proper sampling techniques should be employed to ensure representative samples are collected.
As awareness about food safety constantly grows, the combination of ATP testing and pathogen detection has become a new standard to obtain reliable and meaningful data.

When you use both approaches together, you get a complete picture: on one hand ATP analysis tells you about cleanliness whereas pathogen testing directly identifies dangerous pathogens lurking in the factory environment. Both techniques have their legitimate place in environmental monitoring for food safety.

To make a combination of both approaches as easy and straightforward as possible, NEMIS created the N-Light™ platform – the only solution on the market allowing you to do both ATP testing *and* pathogen detection. By implementing a combination of ATP and pathogen testing, organisations can establish effective cleaning protocols, maintain hygiene standards and safeguard the wellbeing of individuals in various environments. NEMIS makes the lives of food producers easier and their food environments more protected.

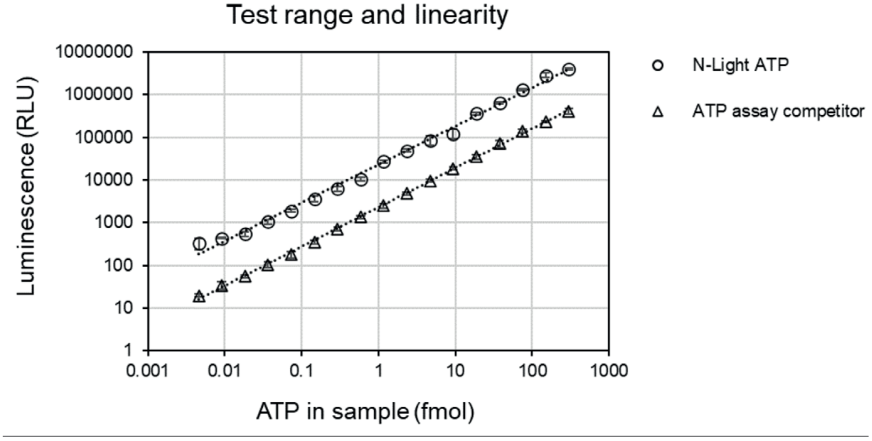

Figure 2: Luminescent signal generated by N-Light™ ATP and by a popular competitor test at different levels of ATP contamination.

AUTHOR:
Stefania Cesarano
Key Account Manager

CO-AUTHORS:
Alina Bohdan
Marketing & Digital Sales Manager
Dr Łukasz Richter
Product Manager
Claudia Ewert
Head of Quality

NEMIS TECHNOLOGIES

For further information, visit:
www.nemistech.com