



Introduction of ATP Test (Kikkoman A3) in the cleaning industry

Presenter

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Introduction

ATP Test (Kikkoman A3) has been used primarily for cleaning assessments in the food and healthcare industry.

Recent years, in the field of cleaning, such as building maintenance and house cleaning, there have been an increasing number of cases that are used to visualize cleaning quality and reduce the risk of infection. We will introduce not only the measurement principles but also the objectives and effectiveness of the introduction, actual measurement examples, and application examples on the utilization of ATP Test (Kikkoman A3) in the cleaning industry.

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1. What is Lumitester Smart and LuciPac A3?

(1) What is ATP Test (Kikkoman A3)?

The biggest feature of ATP Test (Kikkoman A3) is that anyone can easily quantify “soil” in 10 seconds on site. We handle the Lumitester series as a measuring instrument for ATP Test (Kikkoman A3) and the LuciPac series as a reagent. (Photo 1)

ATP Test (Kikkoman A3) is easy and quick procedure. After swabbing the surface with a cotton swab and reagent integrated (hereafter “LuciPac A3”) and allowing the cotton swab and reagent to react, simply set it in the measurement device “Lumitester Smart” (Figure 1). Without special knowledge and skills, the cleanliness (degree of soil) can be evaluated objectively on-site, so it has been introduced in the hygiene management of various facilities.

The term “soil” refers to the total organic matter derived from cells. ATP Test (Kikkoman A3) is a test that quantifies the total amount of soil, including saliva, runny nose, sebum, germs, and food residues.



Photo 1
Left : Lumitester Smart,
Right : LuciPac A3
(for water testing and surface testing)

(2) Field in which ATP Test (Kikkoman A3) are active

Reducing the risk of foodborne illness is one of the most important issues in food-handling facilities. In particular, kitchen knives, chopping boards, and factory lines. The cleanliness control of food touching areas (so-called “product zones”) is highly important. Therefore, ATP Test (Kikkoman A3) is often introduced as a tool for checking whether cleaning has been performed properly after cleaning such areas.

In the past, microorganism-based inspections were the mainstream of environmental hygiene inspections, but ATP Test (Kikkoman A3) featured “anyone can easily and quickly see the results on-site” have been very valuable because the inspections involving cultivation may require expert knowledge and techniques while inspecting. It may take several days before the results can be known. It is also used in health inspections at health centers and in the hygiene management of kitchens in chains with multiple stores.

In medical institutions, environmental hygiene control and equipment (e.g., steel accessories). It is also used in the evaluation of endoscopes cleaning.

Recent years, more are considering installing in areas such as building maintenance and house cleaning.

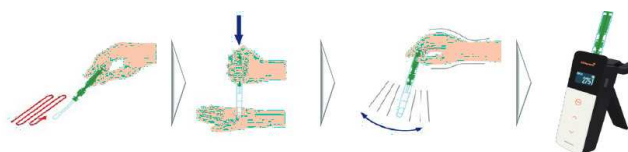


Figure 1 ATP Test (Kikkoman A3)

(3) Principles of ATP Test (Kikkoman A3)

We have received comments from a variety of users that “ATP Test (Kikkoman A3) are a scientifically justified and well-defined test method, so they can be introduced with peace of mind”.

This section briefly explains the principles of ATP Test (Kikkoman A3). ATP (adenosine triphosphate) is a combined substance, a chemical that is present in all organic matter. When one phosphate is removed from ATP, 7.3 kcal is free-energy. Life activities of all living things are carried out using this energy. Therefore, ATP is sometimes referred to as “energy-currency” (Figure 2). ATP is found not only in biological cells but also in human sebum, blood, hair, meat, fish, fruits and also present in microorganisms. Therefore, ATP is also a good indicator of environmental hygiene testing.

ATP Test (Kikkoman A3) responds to the principle of firefly light. It is used as an indicator of soil. The intensity of the emitted light is quantified (Figure 3). Generally, ATP



tests only measures ATP, but our Lumitester & LuciPac A3 measures ATP+ADP+AMP as well as ATP. When ATP is decomposed by heat/fermentation, it becomes ADP (adenosine diphosphate) and AMP (adenosine monophosphate). Our LuciPac A3 can measure ATP+ADP+AMP by using proprietary techniques that return AMP and ADP to ATP. This allows for more rigorous hygiene testing compared to testing using only ATP as an indicator. The test method that measures the “ATP+ADP+AMP” at the same time is called the “A3 method” (Figure 3).



Figure 2 What is ATP?



Figure 3 The principles of ATP Test (Kikkoman A3)

(4) Concept of measured values

Figure 4 shows the results of simultaneous ATP Test (Kikkoman A3) and microbiological tests (culture method) in a large-scale cooking facility. The vertical axis indicates the number of bacteria, and the horizontal axis indicates RLU count*. In the upper-right pink area, both the bacterial count and RLU level are higher. For food facilities, "high RLU value" = "high food residues" meaning nutrient that bacteria tends to grow on still remains. This will lead to high risk of foodborne illness.

On the other hand, the green part at the lower right has a low bacterial count but a high RLU. In this case, food residues

are considered to be high, so secondary contamination of bacteria (cross-contamination) later may increase the risk of foodborne illness. You should be aware of potential risks.

Ideally, this should be maintained in the light blue area in the lower left corner (low bacterial count and low RLU level). The risk of foodborne illness is considered to be very low because the bacteria are removed and the residues that are the nutrient source of the bacteria are removed.

*1 RLU = an abbreviation for Relative Light Unit indicating the amount of light emitted. Units specific to ATP test

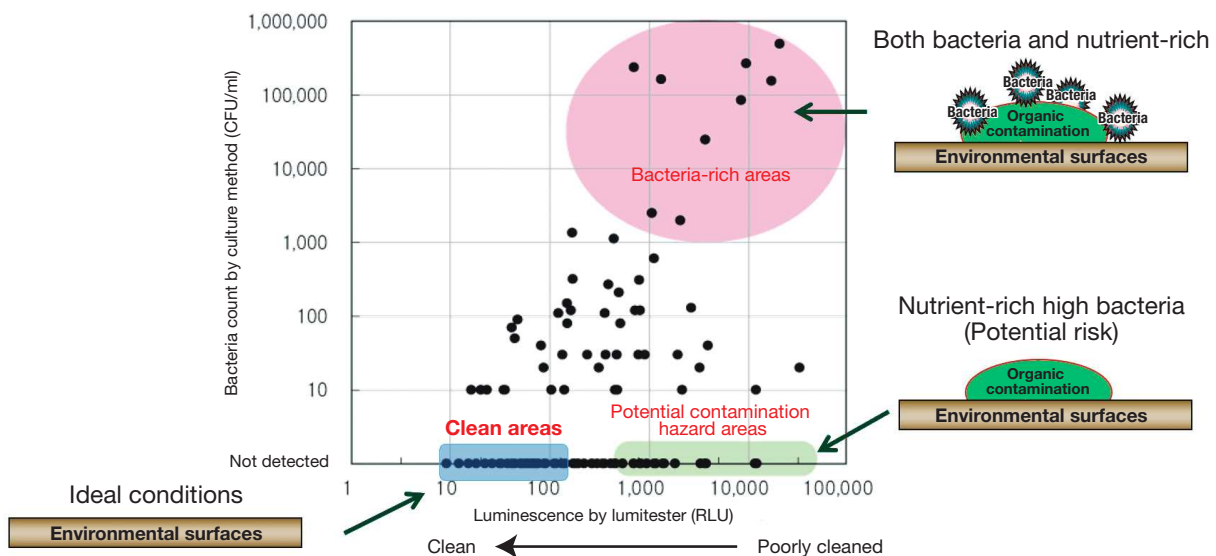


Figure 4 Relation between light emission (RLU) and bacterial count (CFU)



(5) Features of Lumitester Smart -Powerful support for data management

The Lumitester Smart is a device that quantifies “cleanliness” on-site. Data collected at the site can be effectively used as digital data even after leaving the site. For example, by downloading dedicated apps (hereinafter referred to as “Lumitester App”, Figure 5) to devices such as tablets, smart phones, and personal computers, data can be linked by Bluetooth or data can be stored in the cloud.

It is easy to share the results obtained at multiple sites, and to analyze various types of data such as graphs. Users of the Lumitester App also highly praised the fact that the measurement time is automatically recorded, that it is unnecessary to transcribe the site records, and that it is possible to prevent tampering.

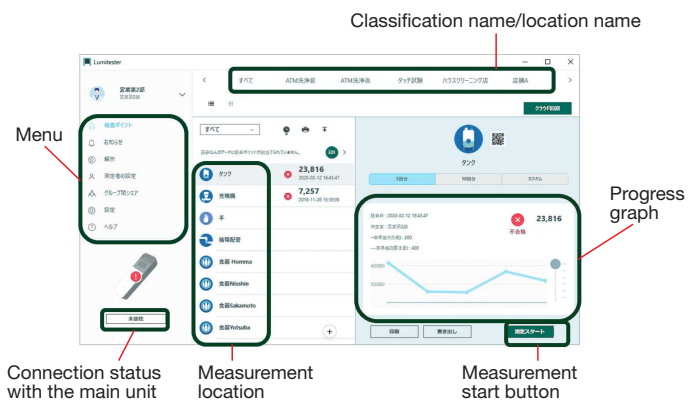


Figure 5
Screen image of Lumitester App (screen for PC and tablets)

2. Purpose and Effects of Introduction

People who introduced ATP Test (Kikkoman A3) in office buildings were asked about their objectives and effectiveness. The main objectives are (1) provision of easy-to-understand services, (2) certification of cleaning quality, (3) environmental hygiene (reduction of infection risk), and (4) verification of certification acquisition. It seems that many companies decided to introduce this system from four perspectives.

Here are some of the objectives and benefits:

(1) Provision of easy-to-understand services

Many companies that provide cleaning services are presenting the values before and after cleaning to customers on the spot. Facilities management departments and consultant services have expressed their opinions that “by indicating whether or not the service is beautiful (not subjective) in numerical terms, it leads to the provision of highly reliable and highly concrete services”.

As for the effect after the introduction, it is possible to quickly and concretely grasp the dirty place, so it is possible to point out the defect of the cleaning method on the spot and to review the cleaning method. If RLU is higher, there is

always some meaning or reason. This can also be a trigger for voluntarily thinking about why the figures have increased?

As the results can be fed back to the site immediately, it is possible to grasp the problem on the spot, solve the problem, and provide education with a sense of speed.

Also, the aesthetics (visual judgment) are subjective and vary from person to person. In particular, it is important to have “common standards of judgment” in the workplace where people from various countries and cultures work. ATP Test (Kikkoman A3) can be used to make objective determinations based on numerical values.

(2) Certification of cleaning quality

In addition to (1) above, many cleaning service providers have also introduced ATP Test (Kikkoman A3) for the purpose of “certification of cleaning quality”. For example, some companies have submitted a report with a photo of the “Lumitester measurement screen” and “Test point”.

If the cleaning service provider can prove the cleaning quality, the client can make the request without anxiety, and it is expected that it will also lead to value-added improvement and differentiation.



(3) Environmental hygiene -reduction of infection risk-

Improving the environmental hygiene of facilities will reduce the risk of infection. Especially in recent years, from the viewpoint of the prevention of infection with COVID-19, thorough countermeasures against the risk of contact infection have been required. Viruses and pathogens may be attached to “soil” that involves saliva, runny nose, fingers, etc. Cleaning, cleaning, and cleaning the surface to remove dirt, and then ATP Test (Kikkoman A3) to quantify “clean” will improve the reliability of both employees and visitors as “safe and secure locations” (Figure 6). This section (5) provides an example of the effect of cleaning.

The Japan Travel Bureau Foundation conducted a survey on “What areas do you want to visit or not in the future? What areas would you like to visit/not want to visit in the future? The survey was conducted in May 2021. The top responses for “areas I want to visit” were “areas I have never traveled to before” and “areas I am attached to,” while “areas I don’t want to visit” were related to infection control.*2

Although infection control is not necessarily the only reason to go, care should be taken at least that the lack of infection control may be the reason to go.

*2 JTB Travel Awareness Survey, “Trends of Japanese Tourists in the Outbreak of New Coronavirus Infectious Diseases,” Japan Traffic Corporation
<https://www.jtb.or.jp/tourism-culture/bunka247/247-09/>

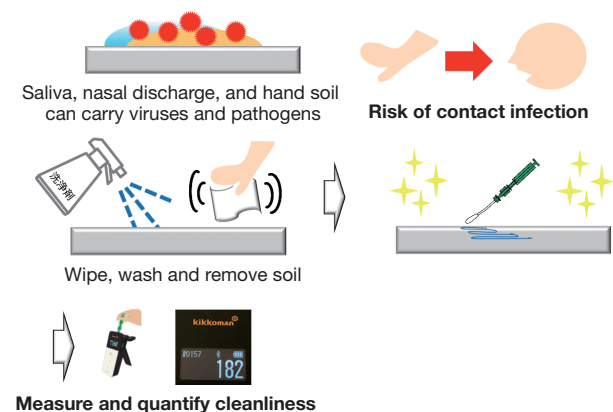


Figure 6

Reducing the risk of infection through environmental hygiene

(4) Verification means at the time of certification acquisition

ATP Test (Kikkoman A3) also functions effectively as a means to verify that it is properly managed when it is audited and audited by a third party. This section introduces two standards.

①ISSA’s GBAC STAR certification

ISSA*3, an international association of cleaning industries, deals with facilities that can appropriately manage the prevention, response, and treatment of infections “GBAC STAR certification”*4 has been implemented.

GBAC Tip Sheet/February 7, 2021 contains six steps of GBAC protocol. The first “Incident Site Risk Assessment - Quality Control” and fourth “Forensic Cleaning” steps contain ATP. When performing biological testing when deciding on a risk-mitigation plan, it is noted that it is appropriate to use, for example, an ATP test to ensure the cleanliness of the initial condition. It also states that if a biological test was performed on an ATP test in advance, a biological test should be performed on ATP test in order to confirm that the cleaning process was effective.

Further, Articles “Assessment of regarding GBAC of ISSA Surfaces/January 8, 2021” is also presented as an objective evidence-based measure of surface-cleaning.

②SGS’s environmental survey service

In addition, SGS Group provides services for verifying and monitoring the effectiveness of infection prevention (cleaning and disinfection) control procedures. There are items such as “Verification and inspection of cleaning and disinfection status” and “Monitoring of cleaning and disinfection control procedures”. In these areas, ATP Test (Kikkoman A3) are used as a means of scientific verification and monitoring in the field.

*3 ISSA=International Sanitary Supply Association (Headquarters: Chicago, U.S.)

*4 GBAC=Global Biorisk Advisory Council (Divisions advocating GBAC STAR certification within ISSA)



(5) Effectiveness of cloth cleaning

I often receive a question, “Is it really effective to clean surfaces with cloth?” so I will introduce an example of how I checked the cleaning effect.

ATP Test (Kikkoman A3) and a culture test for microbes and viruses were performed before and after cleaning with microfiber cloth (Tolecy), and the effectiveness of the cleaning was investigated. The results are shown in Figure 7. ATP Test (Kikkoman A3) and the number of viable bacteria were examined before and after the cleaning process at the desk of a hospital. To the right, simulated saliva including ATP and feline calicivirus were applied to the plastic. ATP Test (Kikkoman A3) and virus titer were measured before and after cleaning. It was confirmed that RLU levels, total viable cell counts,

and viral titers were significantly decreased by wiping.

It should be noted that ATP Test (Kikkoman A3) cannot measure viruses, including COVID-19 directly. Because viruses are composed of genetic material such as DNA and RNA that fit within the lipid-protein shell, they do not contain ATP themselves. For direct detection of viruses, use PCR tests.

Direct measurement of the virus is not possible. However, it is possible to check whether soil such as runny nose, saliva, and dirt carried by hands that may be contaminated with the virus can be removed by cleaning and washing, which is thought to reduce the risk of infection.

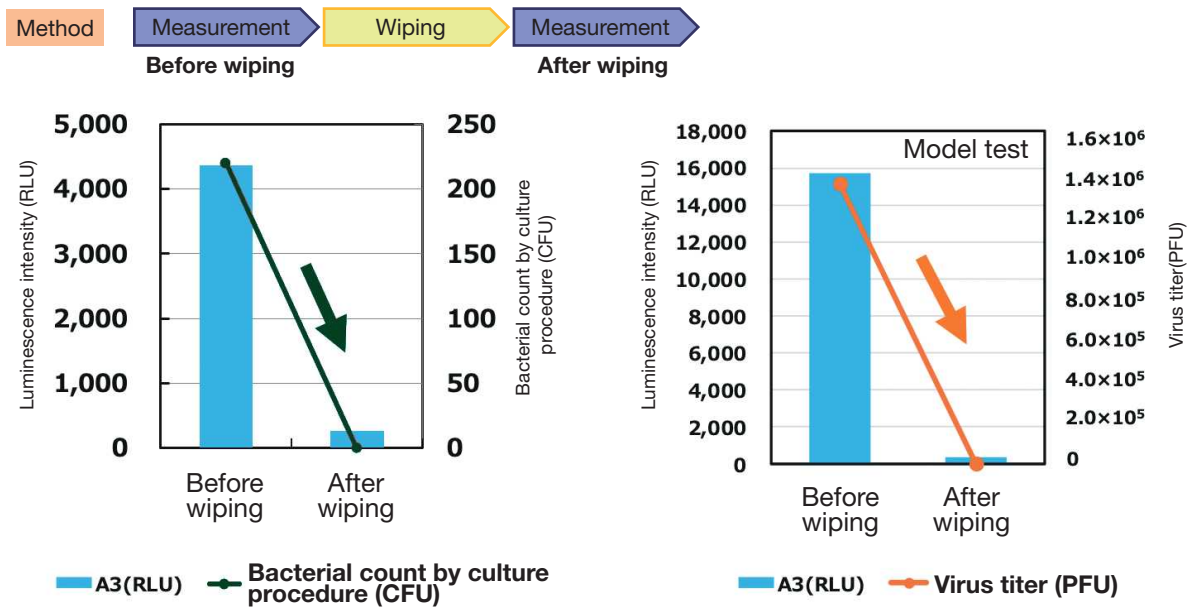


Figure 7 Effect of cloth cleaning Model test



3. Example of measurement in office buildings

In concrete terms, we will introduce how ATP Test (Kikkoman A3) can be performed in office buildings. Swab the same area with two cotton swabs at 24 locations in a certain building (reception area, elevators, offices, toilets, etc.), and wipe one side with ATP Test (Kikkoman A3) and

the other was tested for bacteria.

Measurements were performed prior to and after cleaning using Tolecy and Easy Plate AC (manufactured by Kikkoman Biochemifa.Co., Ltd) was used for bacterial testing (Figure 8).

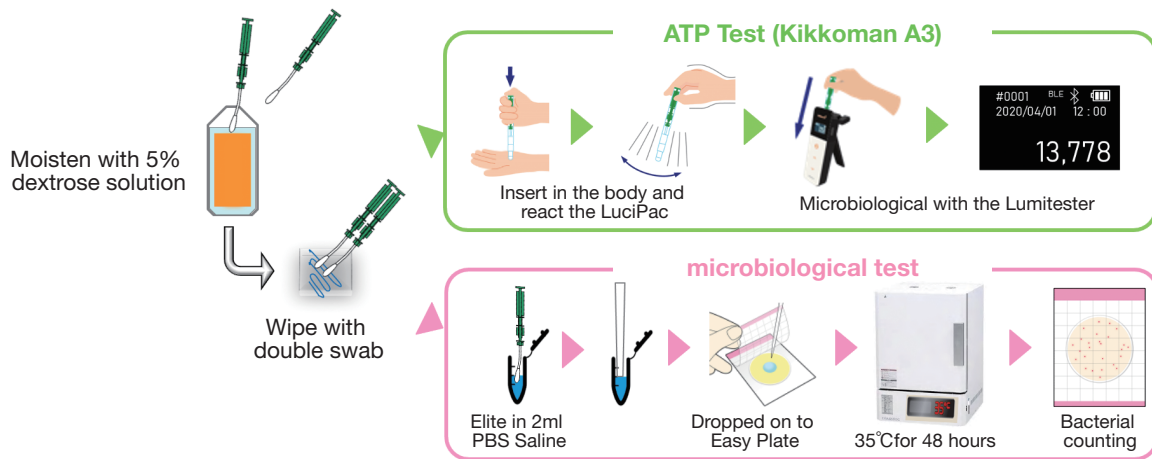


Figure 8 ATP Test (Kikkoman A3) and microbiological test in office buildings

(1) Results of ATP Test (Kikkoman A3)

ATP Test (Kikkoman A3) showed that there was a variation in the distribution before cleaning, but the concentration was low after cleaning, and the mean value after cleaning was 1,021 RLU and good. 80% tiles of measured values after cleaning (80% from the smaller value of the result) are 1,555 RLU, and from these results, office buildings with less than

2,000 RLU after cleaning. If the standard is 2000 RLU after cleaning, it can be said that the cleaning was carried out properly at the site. (Figure 9).

※Based on the acquired data, the standard values are reviewed according to the purpose, environment, and situation of the inspection.

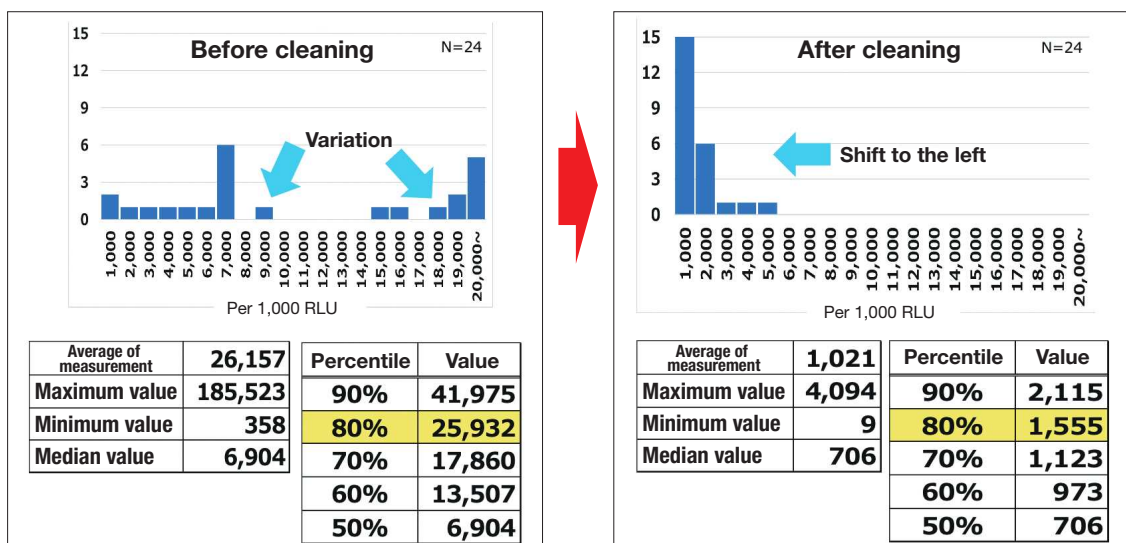


Figure 9 Change in measured value (RLU value) by ATP Test (Kikkoman A3) before and after cleaning



(2) Results of general viable counts

As for the results of the bacterial test, the measured values of the toilet washstand and door were slightly higher before cleaning, and a certain number of bacteria was found on the office door, telephone button, and reception table, but other than that, the number of bacteria is small (Figure 10). After

cleaning, everything is less than 20 CFU and daily cleaning is carried out.

The low bacteria count was also due to the fact that the number of users was lower than usual during the period.

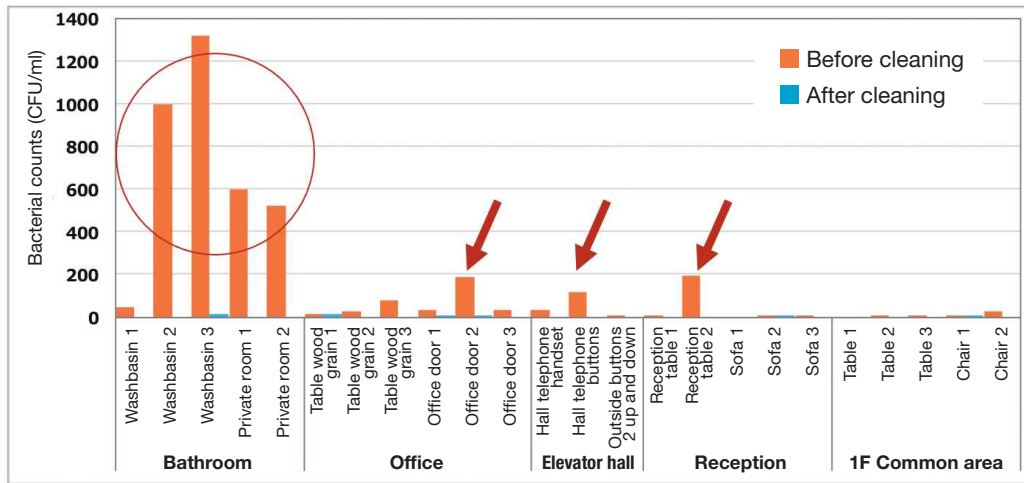


Figure 10 Changes in the number of viable bacteria before and after cleaning

(3) Correlation between ATP Test (Kikkoman A3) and microbiological test

Figure 11 shows the changes in ATP Test (Kikkoman A3) and bacterial test before and after cleaning. The plot distributed in the upper right (orange color) before cleaning is

moved to the lower left (light blue color) after cleaning.

It was confirmed that both the bacterial count and RLU level were clearly low.

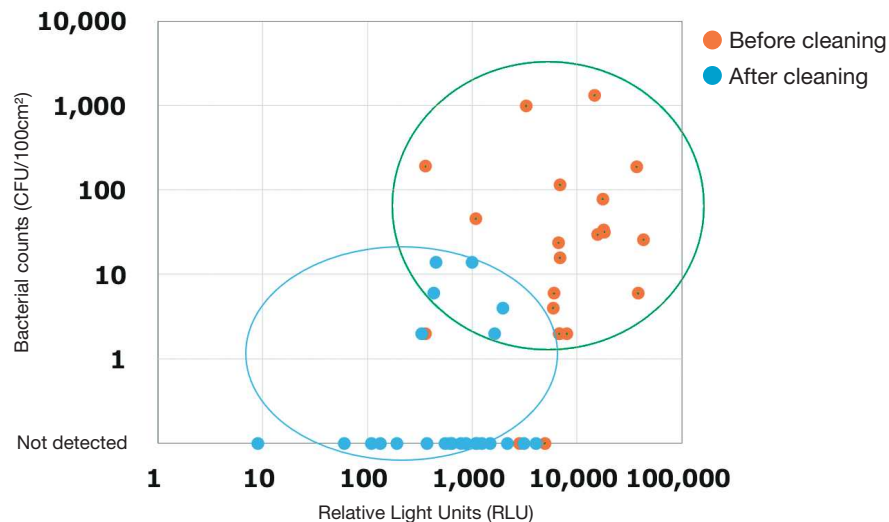


Figure 11 ATP Test (Kikkoman A3) and bacterial test before and after cleaning



4. Examples of applications in the cleaning field

Below are some examples of the use of ATP Test (Kikkoman A3) in the cleaning industry.

(1) Osoji Honpo

Osoji Honpo (HITOWA Life Partner Co., Ltd.) uses ATP Test (Kikkoman A3) to clean the reheating piping of bath rooms and drum-type washing machines. Implementation of ATP Test (Kikkoman A3) before and after cleaning clearly conveys the effectiveness of cleaning. (Photo 2)

As an example of a pass/fail limit, the pipe inlet has a rule of “re-clean when 500 RLU is exceeded”.

For a period of time (n=1793), the mean of before cleaning was 92,408 RLU, but after cleaning it was significantly improved to 134 RLU (left-hand in Figure 12). In addition, looking at the distribution after cleaning (to the right in Figure 12), we found that there was little variation in RLU values. 90 percentile was 342 RLU, and we were able to confirm that the standard value of 500 RLU was appropriate.



Photo 2 : Example of using ATP Test (Kikkoman A3) in the cleaning service business

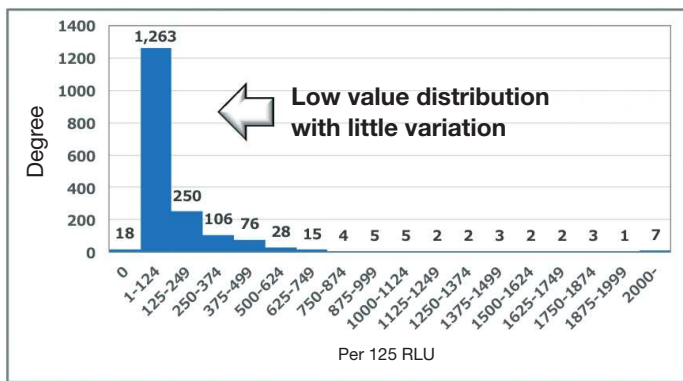
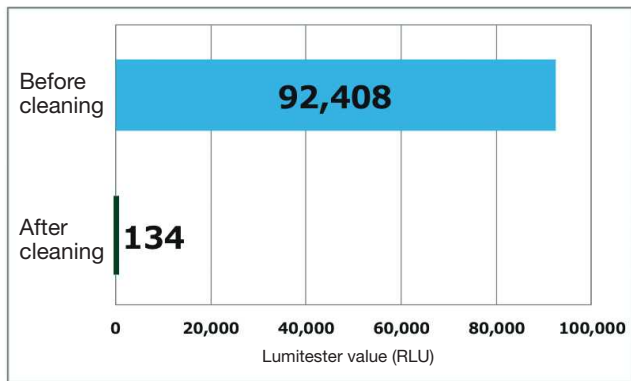


Figure 12 Changes in the measured value (RLU value) of ATP Test (Kikkoman A3) before and after cleaning the reheating piping in the bathroom



(2) Kao Professional Services Co., Ltd.

Kao Professional Services Co., Ltd. uses ATP Test (Kikkoman A3) to support the standardization of cleaning procedures.

One hotel worked with Kao Professional Services to improve guest room cleaning and enhance the quality of cleaning to ensure that guests can use the hotel with safely. ATP Test (Kikkoman A3) was conducted at 45 locations in the guest rooms. There were 20 locations that passed the test (light blue on the table), 6 locations that required caution (yellow on the table), and 19 locations that failed the test (pink on the table) (Pass: below 2,000 RLU, Fail: 3,000 RLU). We also found

that RLU after cleaning was generally low (Figure 13).

Based on these results, we are working to improve the cleaning specifications and improve the quality of the cleaning. For example, ATP Test (Kikkoman A3) was added to the areas requiring special attention (e.g. shoehorns and hangers) and the “failed” areas as the new areas where ATP Test (Kikkoman A3) is performed after cleaning. We are also working to establish new cleaning specifications that take hygiene measures into consideration.

Test point group	Test point	RLU values	Measurement results
Guest Room	Entrance doorknob	15,143	Fail
	Entrance doorknob	13,660	
	Closet door	10,848	
	Presser	8,560	
	Intercom	7,510	
	Safety BOX	7,370	
	Shoehorn	2,705	Caution
	Hanger	2,468	
	Card	2,355	Pass
	Brush	1,532	
Card	1,226		
Card	1,226		
Guest room desk	Desk surface	30,360	Fail
	Cabinet handles	8,672	
	3 books	5,407	
	Chair handles	4,944	
	TV remote	1,942	Pass
	Glass table	1,743	
	Lamp switch	59	

Test point group	Test point	RLU values	Measurement results
Guest room bathroom	Floor: middle section	7,301	Fail
	Floor: back section	5,255	
	Amenity BOX handles	4,770	
	Volume switch	4,638	
	Toilet seat with bidet functions	3,984	
	Door: exterior	2,483	
	Power switch	2,361	
	faucet	1,866	Pass
	Telephone	1,482	
	Dryer	1,406	
Door: interior,	1,404		
Floor: front section	1,088		
Toilet seat	831		
Paper holder	786		

Test point group	Test point	RLU values	Measurement results
Room furnishings	Refrigerator handles	9,600	Fail
	Air purifier	8,195	
	Kettle	4,662	
	Cabinet handles	3,859	
	Cabinet handles	2,342	Caution
	Night lamp switch	1,919	Pass
	Light switch	1,909	
	Cards for sheet changing	1,880	
	Telephone	1,803	
	Aircon switch	1,496	
Alarm clock	1,082		
WI-FI pouch	1,050		
Pen	424		

Table Example results of ATP Test (Kikkoman A3)

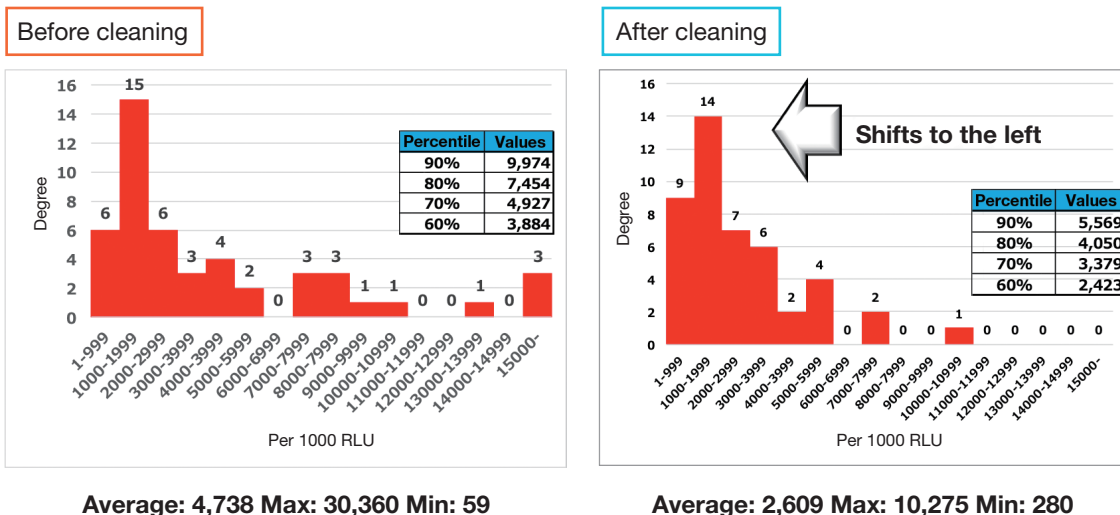


Figure 13 Changes in RLU before and after cleaning at hotels



(3) E-net Co., Ltd.

As part of the “Clean Protection Project” (from April to September 2021), E-net Co., Ltd. has been providing services to thoroughly remove organic matter from ATM displays and numeric keyboards installed in convenience stores using electrolyzed water and microfiber cloth, and to confirm the cleaning qualities using ATP Test (Kikkoman A3) (Pass/ fail limit: 1,000 RLU), and then attach antiviral and antimicrobial films.

ATP Test (Kikkoman A3) of the display and 15 numeric keypads are carried out for ATM installed in more than 10000 locations nationwide, so a huge amount of data is accumulated. Data is managed centrally in the cloud using the Lumitester App.

(4) Andaz Tokyo and Aeon Delight Co., Ltd.

Andaz Tokyo (Mori Building Hospitality Corporation), which operates accommodations and eating and drinking facilities, conducts ATP Test (Kikkoman A3) to evaluate cleanliness through the promotion of HACCP and environmental hygiene initiatives acquiring GBAC STAR certification.

Aeon Delight Co., Ltd., which manages the various facilities of the Aeon Group, is also considering an ideal cleaning business with an eye to the “after-sales corona era.” The Company has devised the concept of New Standard Cleaning (NSC), which combines aesthetics and infection-control measures, and is using ATP Test (Kikkoman A3) in its construction and operation.

Please refer to our website for details on the use of these two companies.

○ Andaz Tokyo:

<https://biochemifa.kikkoman.com/download/?id=205&k=2>

○ Aeon Delight:

https://biochemifa.kikkoman.com/e/kit/article/article_detail_123/



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