Food Safety and hygiene monitoring ATP methods

Nobuyoshi Sato M.Sc.

kikkoman
Kikkoman Biochemifa Company

Agenda

Kikkoman Soy Sauce Brewing

Why do food poisoning incidents occur?

How can we prevent food poisoning incidents?

What is ATP? What is ATP test?

ATP test performed worldwide

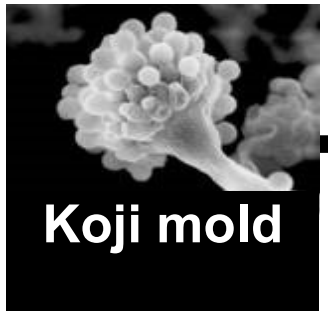
Guideline

ATP test conducted in Vietnam

Workshop

Let's try using ATP test in actual hygiene instruction

Soy sauce brewing



Enzyme

Koji mold

← Salt water

← yeast, lactic bacteria

Moromi (4 months)

Solid–liquid separation

Heating
(Pasteurization)

Enzyme

Soy sauce is produced through the action of enzymes generated by microorganisms.

Enzymes for In Vitro Diagnosis

Raw materials for In Vitro Diagnostic Reagent

- Glucose Dehydrogenase for Glucose assay
- Fructosyl Peptide oxidase for HbA1c assay
- Creatinase for Creatinine assay
- Uricase for Uric Acid assay

Food Safety & Hygiene Monitoring

ATP(A3) hygiene monitoring test

Enzymes for In Vitro Diagnosis

Raw materials for In Vitro Diagnostic Reagent

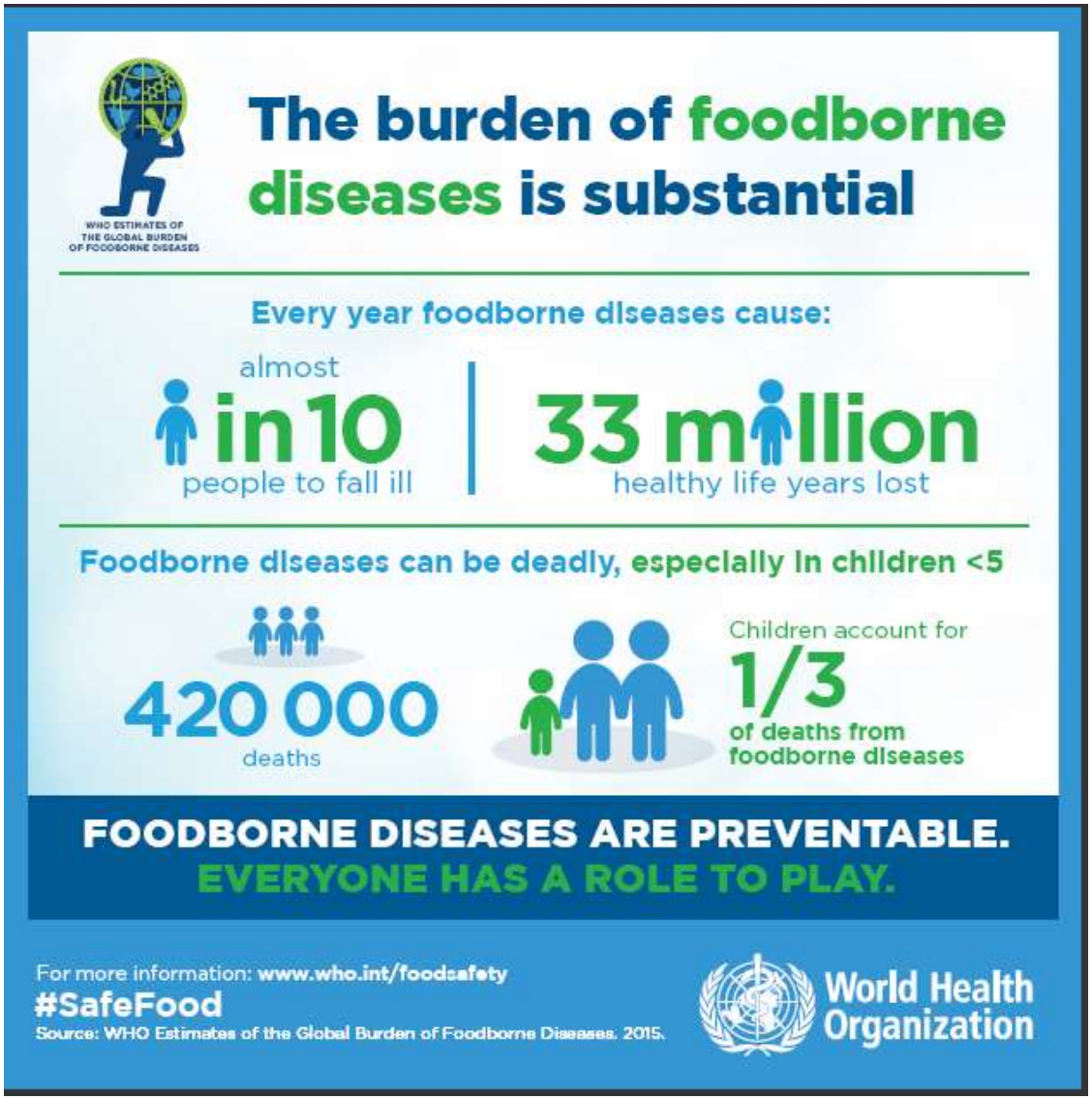
- Glucose Dehydrogenase for Glucose assay
- Fructosyl Peptide oxidase for HbA1c assay
- Creatinase for Creatinine assay
- Uricase for Uric Acid assay

Food Safety & Hygiene Monitoring

ATP(A3) hygiene monitoring test

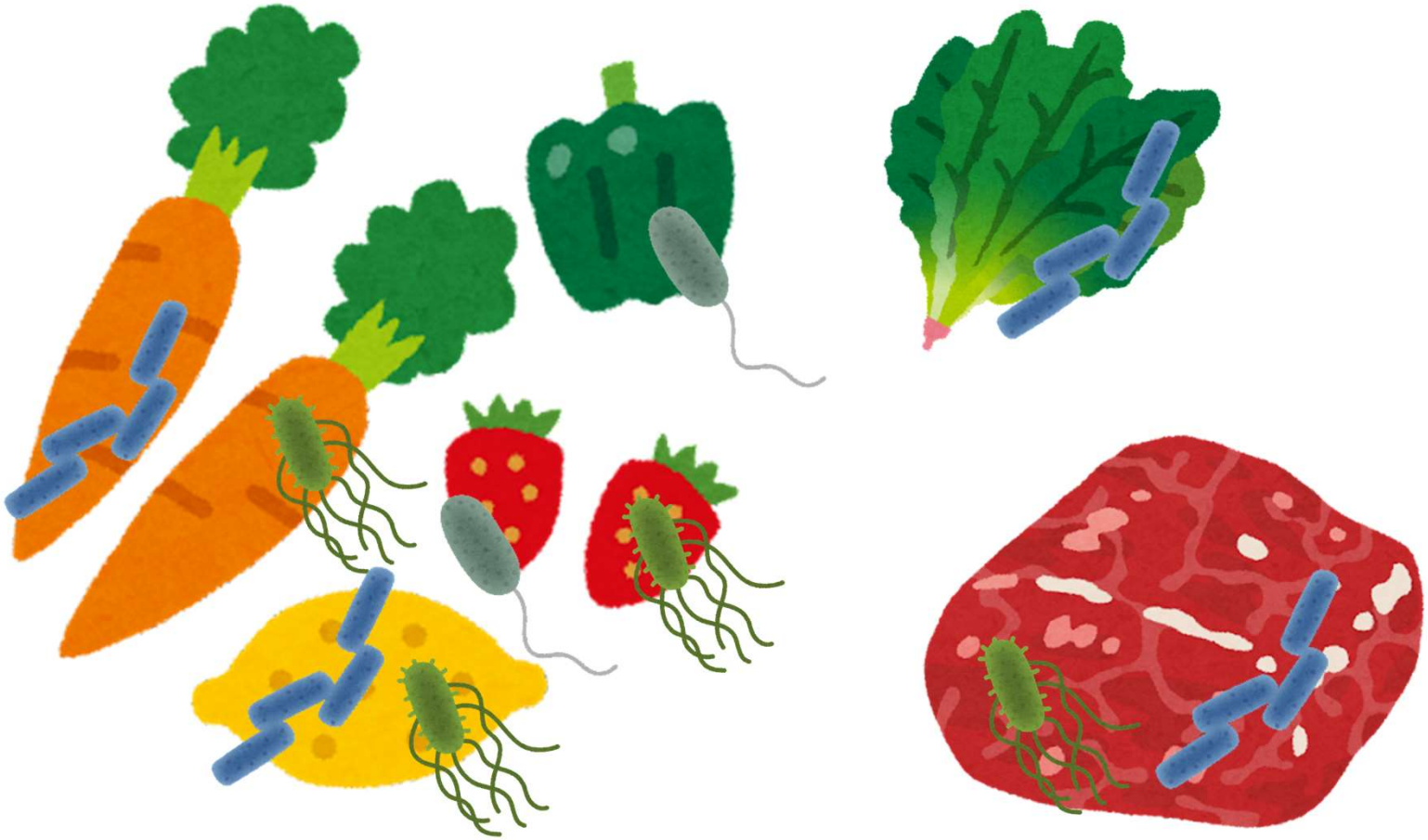
Food poisoning incidents occur

in many countries around the world.



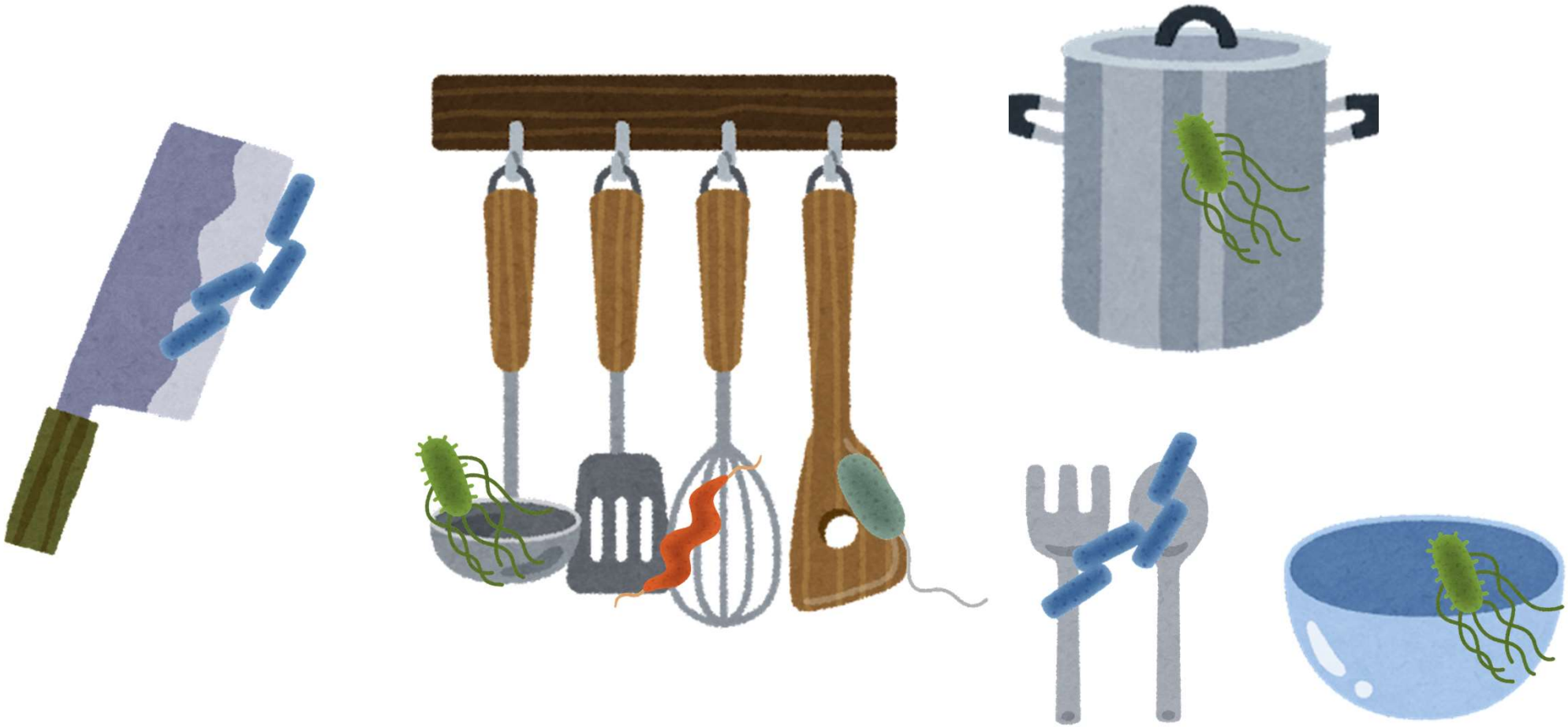
Why do food poisoning incidents occur?

1. Food is contaminated with foodborne pathogens



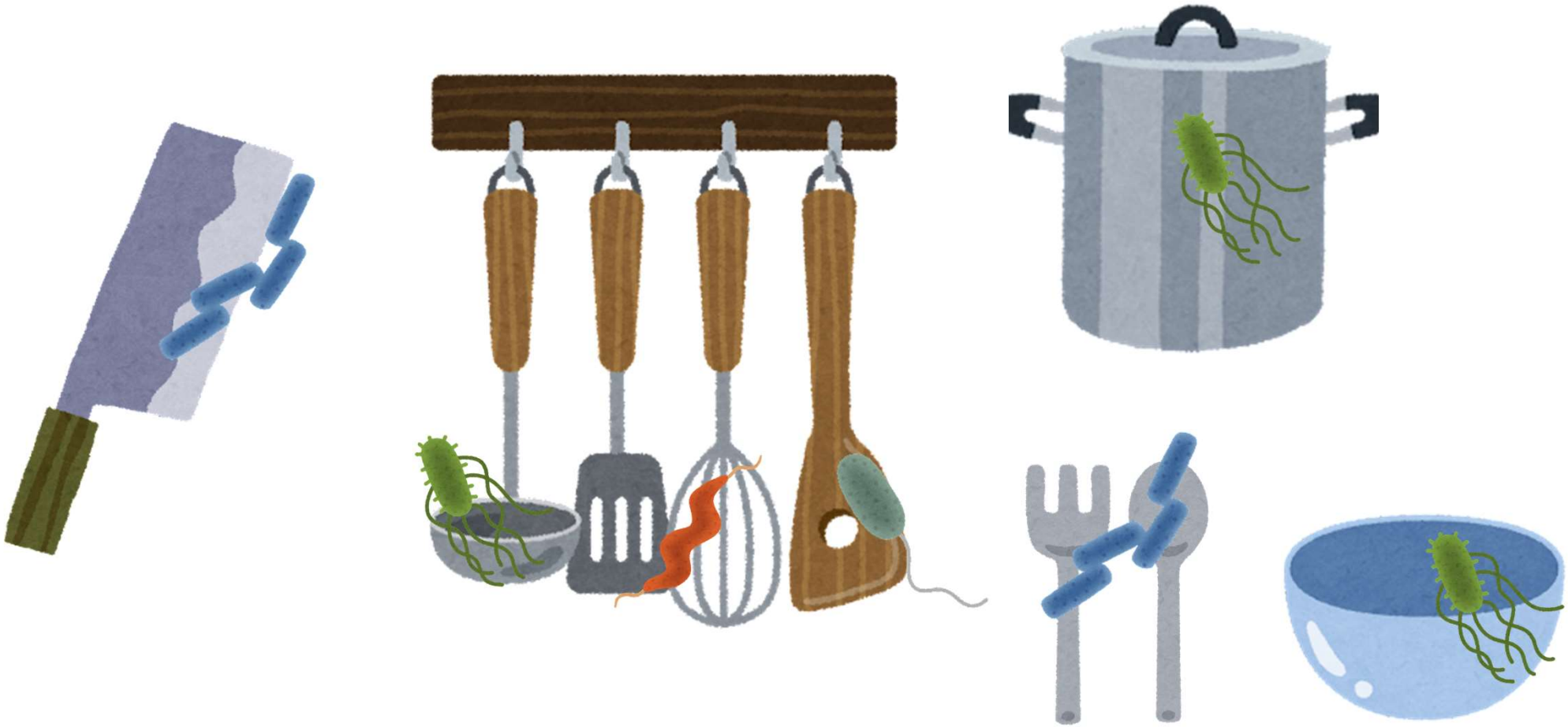
Why do food poisoning incidents occur?

2. Cooking utensil is contaminated with foodborne pathogens



Why do food poisoning incidents occur?

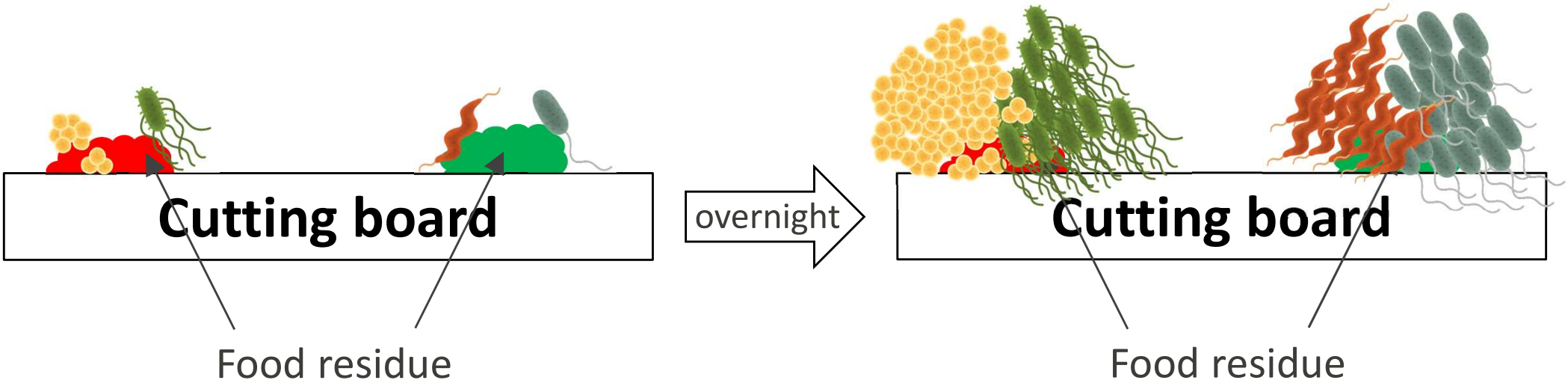
2. Cooking utensil is contaminated with foodborne pathogens



Food residue left on cooking utensils is also risk factor

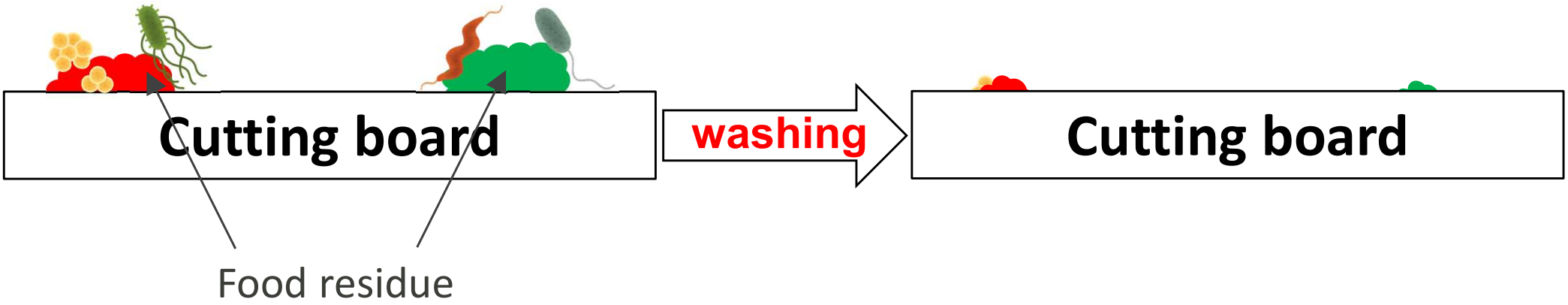
Doubling time: 20min.

hours later	numbers
0	1
4	4,096
8	16,777,216
12	68,719,476,736



Food residue provides an excellent nutrient source for foodborne pathogens.

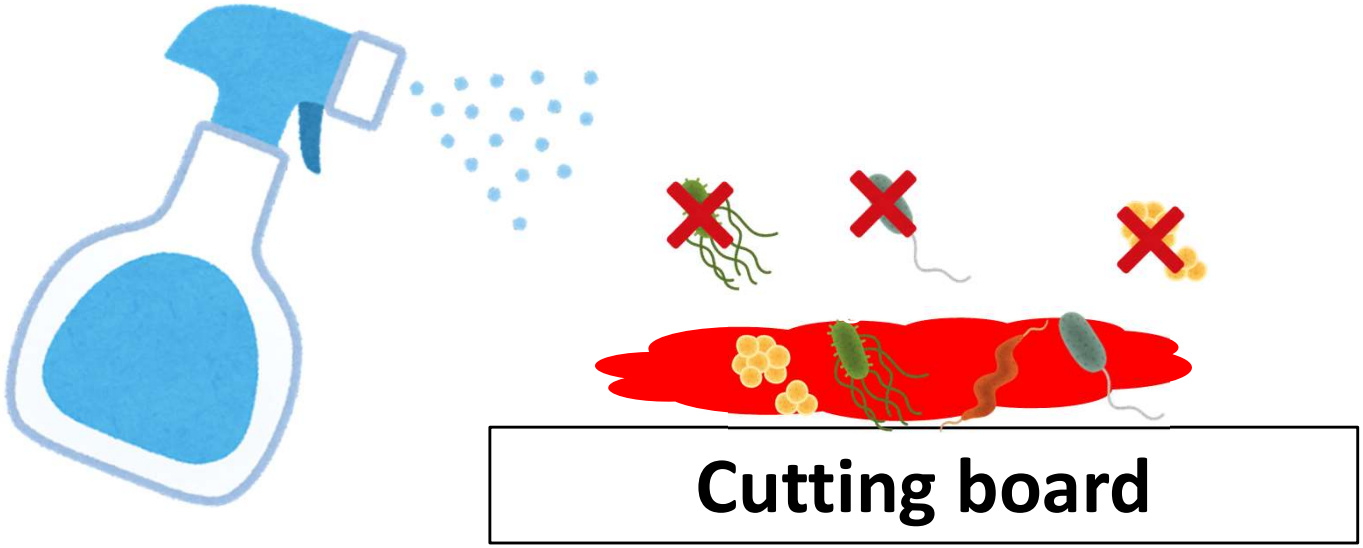
How can we prevent food poisoning incidents?



Thorough washing is essential to reduce both foodborne pathogens and food residue.

Disinfectant spray?

is not sufficient.



Food residue can act as a shelter for pathogens. Disinfectants cannot kill pathogens unless they come into direct contact.

Washing is very important

So kitchen staff wash everyday

Kitchen staff knows that it is very important to wash cooking utensils.

Was the washing done properly?

Washing involves:

- Procedure
- Detergent
- Temperature
- Time
- Rinsing

Was each step performed correctly?
It looks clean, but is it truly clean?

How can we verify that the washing was performed correctly?
“washed” doesn't mean “cleaned”.

“ATP(A3) test” can confirm Cleanliness

Lumitester Smart

LuciPac A3 Surface

With the ATP(A3) test, anyone can easily verify whether washing has been properly performed right on site, in just 10 seconds.

Demonstration

Lumitester Smart

LuciPac A3 Surface

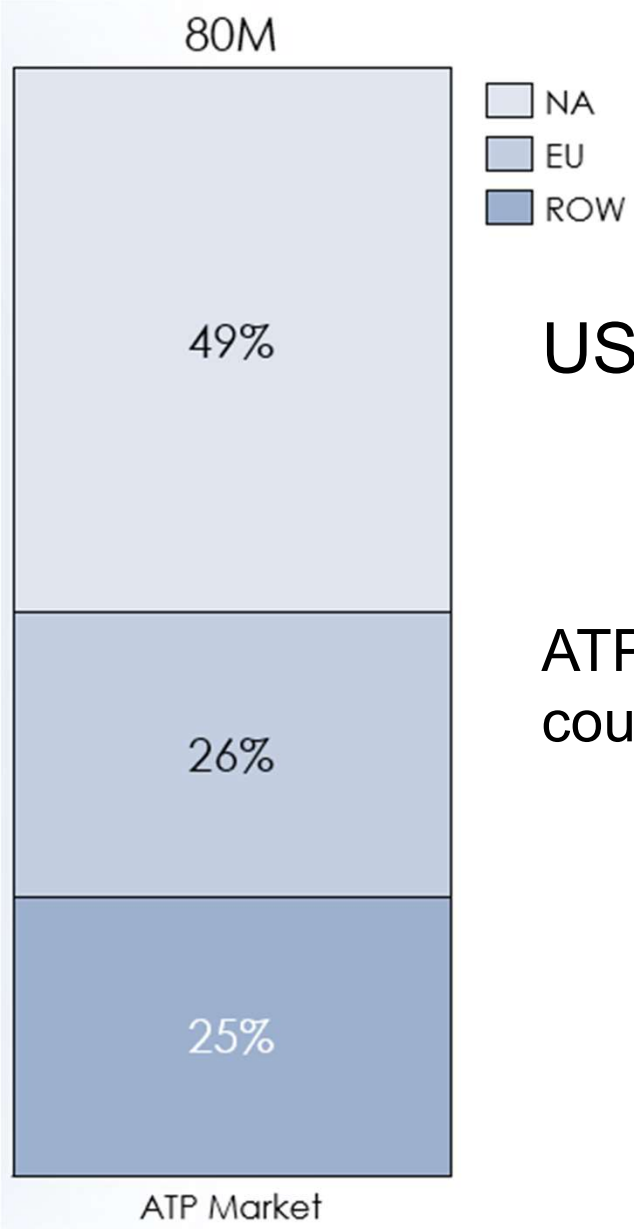
ATP(A3) test is performed by sanitation inspectors in Japan






Public health inspectors in Japan use the ATP (A3) test during hygiene inspections at food service facilities.

ATP test – Market size (worldwide)



USD 80,000,000 = VND 2,100,200,000,000

ATP test is a widely used routine test conducted in countries around the world.

rapid
easy
accurate
reliable
the results are obtained numerically

source: Strategic Consulting International, Inc.

How ATP Test Aligns with FDA & USDA Principles

FDA: Food and Drug Administration
USDA: United States Department of Agriculture
CFR: Code of Federal Regulations

- FDA (21 CFR 117.35): Food-contact surfaces must be cleaned and sanitized to protect against contamination.

- FDA (21 CFR 117.80(c)(1)): Manufacturing operations must ensure all equipment is maintained in a clean and sanitary condition.

- USDA (9 CFR 416.4): Food-contact surfaces must be cleaned and sanitized to prevent adulteration.

ATP testing provides rapid, objective verification that cleaning removed organic residues.
While FDA and USDA do not explicitly recommend ATP test, its ability to validate and verify effective cleaning aligns fully with their sanitation philosophy.

CDC (Centers for Disease Control and Prevention)

Options for Evaluating Environmental Cleaning

Prepared by:
Alice Guh, MD, MPH[1]
Philip Carling, MD[2]
Environmental Evaluation Workgroup[3]

December 2010

[1]Division of Healthcare Quality Promotion, National Center for Emerging and Zoonotic Infectious Diseases, CDC, Atlanta, Georgia
[2]Carney Hospital and Boston University School of Medicine, Boston, MA; Dr. Philip Carling has been compensated as a consultant of Ecolab and Steris. He owns a patent for the fluorescent targeting evaluation system described in this document (DAZO Fluorescent Marking Gel).
[3]Brian Koll, Beth Israel Medical Center, New York, NY; Marion Kainer and Ellen Borchers, Tennessee Department of Health, Nashville, TN; and Brandi Jordan, Illinois Department of Public Health, Chicago, IL

CDC (Centers for Disease Control and Prevention)

ATP Bioluminesence – The measurement of organic ATP on surfaces using a luciferase assay and luminometer has been used to evaluate cleanliness of food preparation surfaces for more than thirty years. A specialized swab is used to sample a standardized surface area which is then analyzed using a portable handheld luminometer. The total amount of ATP, both microbial and non-microbial, is quantified and expressed as relative light units. Although readout scales vary more than 10 fold and sensitivity varies between commercially available systems, very low readings are typically associated with low aerobic colony counts (ACCs).[6] Very high readings may represent either a viable bioburden, organic debris including dead bacteria or a combination of both. An independent study in 2007 by the U.K. National Health Service evaluating the potential role of the ATP tool in assessing cleaning practice concluded that the tool could potentially be used effectively for ES education.[7] Although it is likely that part of the lack of correlation between ATP readings and ACCs noted in the preceding studies relates to the fact that ATP systems measure organic debris as well as viable bacterial counts, several studies have noted additional environmental factors which may increase or decrease ATP readings. Because a large proportion of surface contamination with ATP is non-microbial in origin, surfaces that are effectively disinfected but less effectively cleaned may be more likely flagged as failing to meet a quality standard

using the ATP tool than one of the culture techniques. Additionally, high concentrations of bleach may potentially quench the ATP bioluminescence reaction and result in a signal reduction, but further research is needed to better understand the impact of bleach-based disinfectants on the use of the ATP system. If a bleach-based disinfectant is used, it is important that the surface is dry before using the ATP tool. Similar to the culture methods described above, it is unclear whether "threshold values" for a clean hospital surface can be established using existing methods, suggesting use of the ATP tool is likely to require pre-cleaning levels of contamination for each object evaluated in order to accurately assess cleaning practice. Despite these limitations, the ATP system has been used to broadly document significant improvement in daily cleaning as well as provide quantitative measurement to indicate the level of cleanliness of high touch surfaces.[8,9]

Guideline in Japan - Ministry of Health, Labour and Welfare

（1）ATP 法の測定原理

ATP は，Mg イオン存在下でルシフェリンとルシフェラーゼが反応し，発光を行う．発光量は ATP 量に比例することから，発光量を測定することにより微生物やその他の生細胞内の ATP 量を求めることができる．

（ルシフェラーゼによる発光反応）

ATP ＋ ルシフェリン ＋ 酸素

| ルシフェラーゼ

AMP ＋ ピロリン酸 ＋ オキシルシフェリン ＋ 二酸化炭素 ＋ 光

［ 大量調理施設における食品の調理編 ］

introduction
GUIDE BOOK
厚生労働省

Guideline in Japan - Ministry of Agriculture, Forestry and Fisheries

MAFF
Ministry of Agriculture, Forestry and Fisheries
農林水産省

maffchannel

@maffchannel・チャンネル登録者数 4.67万人・5778 本の動画

農林水産省の公式チャンネルです。記者会見や農林水産省の施策に関する情報、

maff.go.jp

チャンネル登録

YouTube JP

検索

「ATP検査法の手順」

maffchannel
チャンネル登録者数 4.67万人
チャンネル登録
高評価
共有
保存
オフライン

Guideline in Japan - Ministry of Education, Culture, Sports, Science and Technology

2. ATP測定による清浄度検査

ATP（アデノシン三リン酸）（図1）とは、地球上すべての生物の生命活動を司るエネルギー物質であり、食品（動物・植物）はもちろん、細菌にもATPは存在します。逆に、生物以外のもの（金属など）には存在しません。

そのため、ATPが存在するということは、そこに生物あるいは生物由来の生産物が存在する証拠となります。

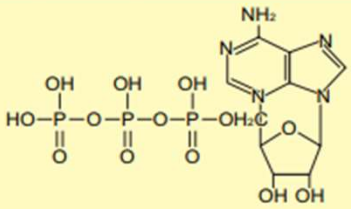


図1　ATP（アデノシン三リン酸）

地球上の全生物が持っている化合物でエネルギー源となります。

「細菌」も生物ですのでATPとして検出されます。なお、現在のATP法では「汚れ」と「細菌」を区別することはできません。しかし、「汚れ」が残っていると、細菌増殖の原因となったり、消毒効果が損なわれたりすることがあります。

ATP法は、洗浄後にATP測定による清浄度検査を行い、一定以上の値が出た場合には、再度、洗浄した後で「消毒」することが必要です（図2）。

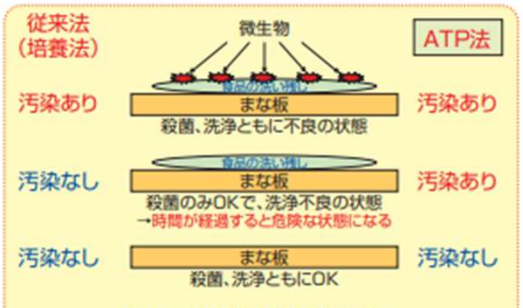


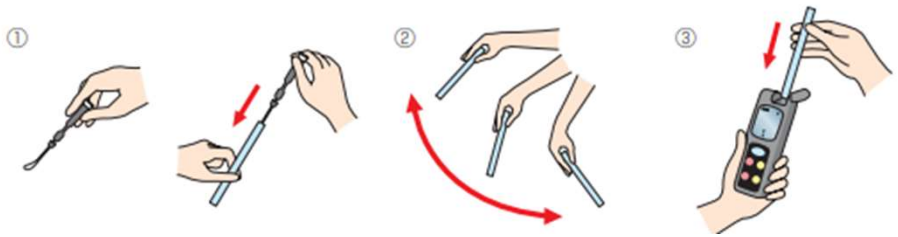
図2　ATP法と培養法の違い

（食品衛生検査指針微生物編2004年　P72より引用）

ATP拭取り検査は、サンプリングから測定まで数十秒から数分で結果が得られ、迅速性があります。ATP測定機器と試薬が必要ですが、操作は極めて簡便であり、誰でも実施できます。

<検査方法>

①検査キットの拭取り棒を用いて、表3に従って綿球全体でムラなく拭き取ります。
②検査キットの拭取り棒と試薬を混合して、よく振ります。
③②をATP測定器にセットし、判定（発光量が数値化される）します。



Field survey conducted in Vietnam

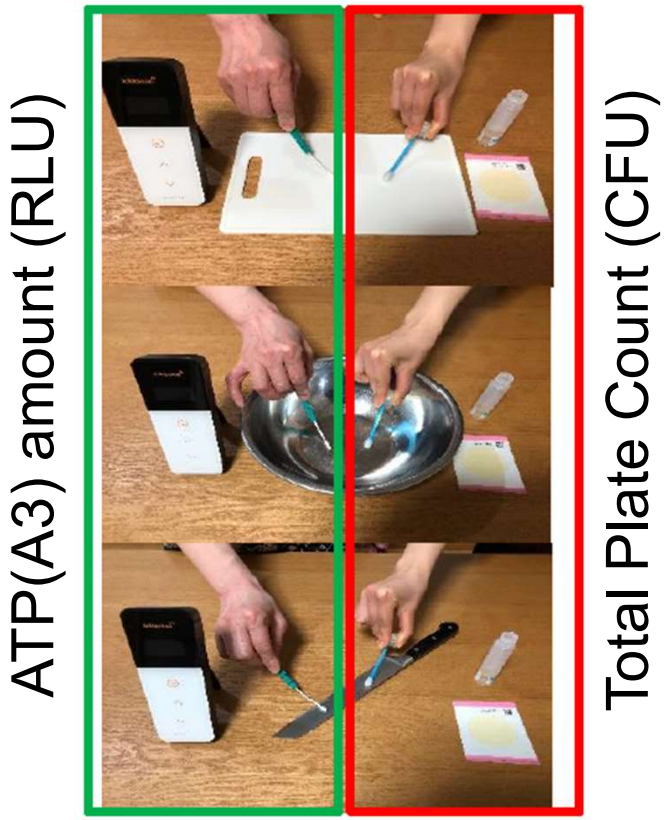
We evaluated the applicability of ATP test in Vietnam.

Materials & Methods

Ten kitchens in the suburbs of Hanoi
(hospital, school and industrial parks)

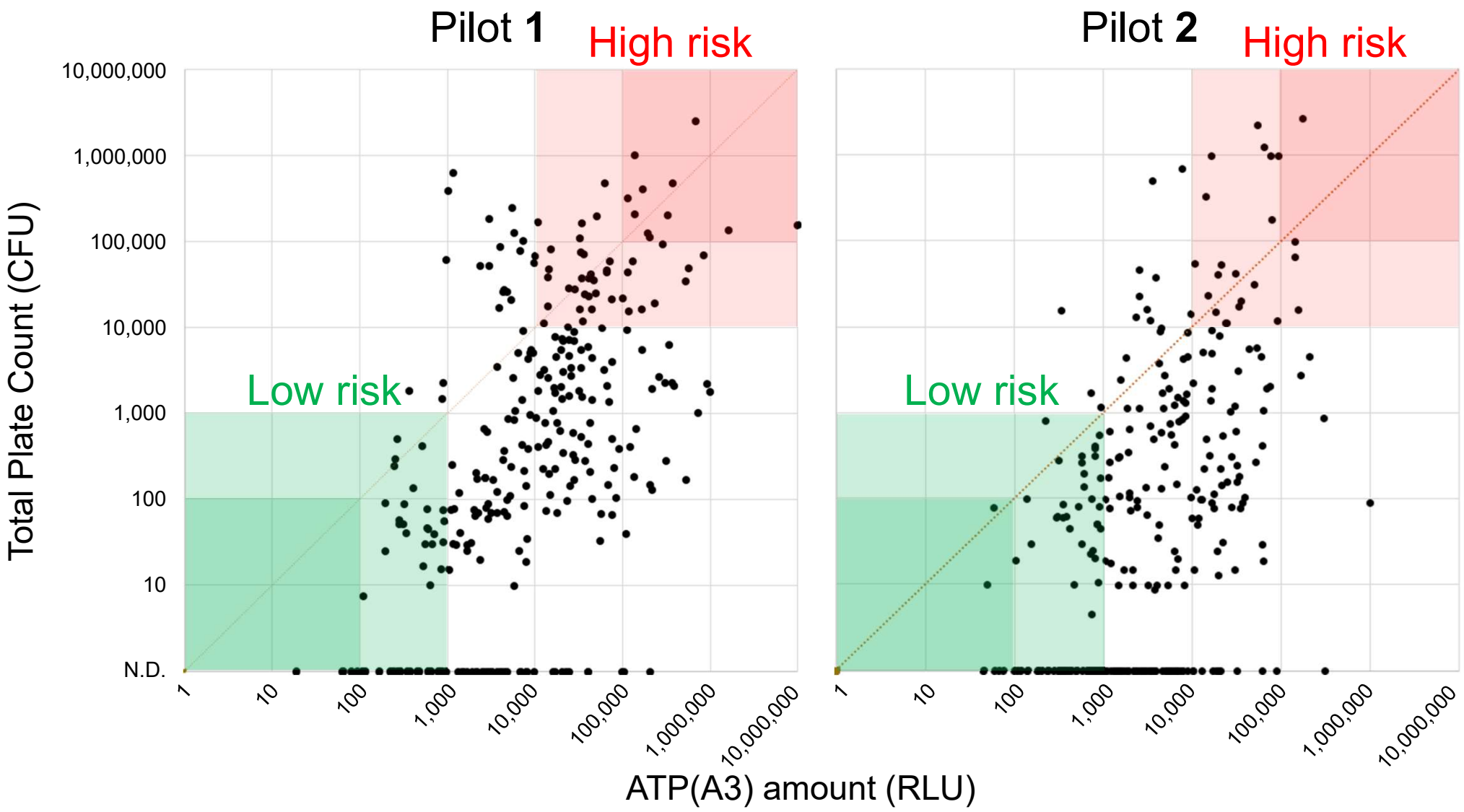
April 2025 — Pilot 1:
Measurements were conducted without any prior explanation,
and the results were reported to each facility.

May 2025 — Pilot 2:
Measurements were conducted after giving advance notice that the same locations inspected in Pilot 1 would be examined again.



Wiping the adjacent area
(10x10 cm)

Results



Pilot 2 shifted to the lower values for both RLU and CFU compared to Pilot 1.

Results

Pilot 1

Pilot 2

After reviewing Pilot 1 report, they decided to buy a brand-new cutting board. Their mindset has changed by ATP test.

Because…

After reading the Pilot 1 report, the kitchen staff became aware of their own level of cleaning.

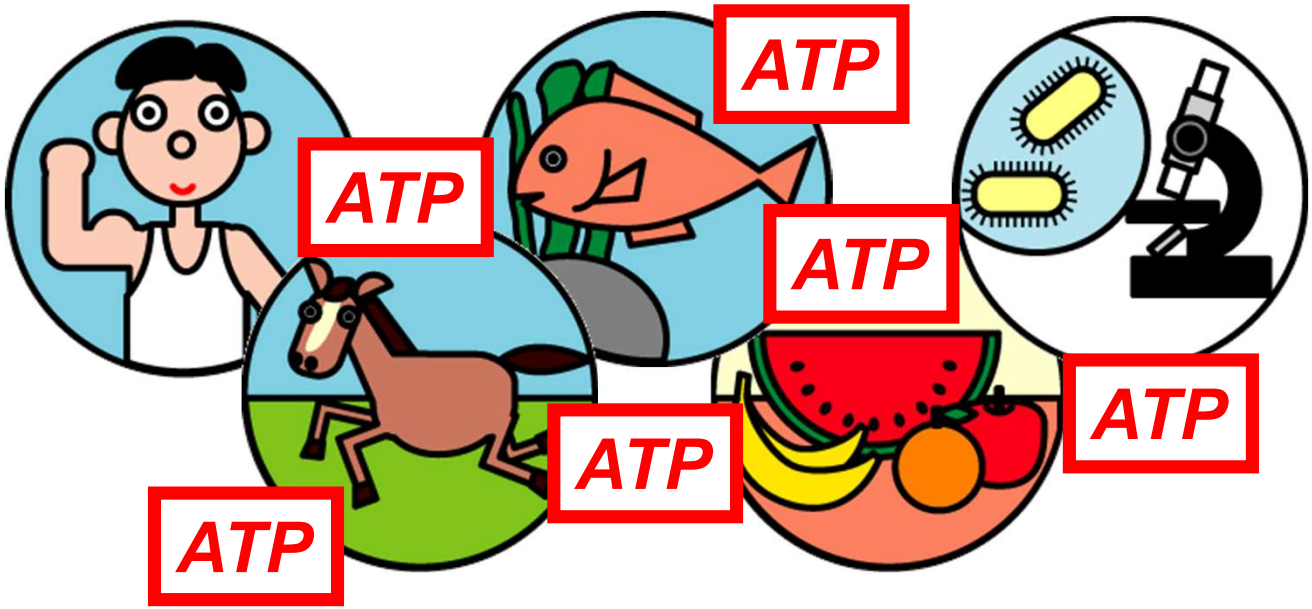
They realized that the current situation was not acceptable, so they carried out the cleaning more carefully after Pilot 1.

As a result, the values were lower in Pilot 2, and the cooking utensils/equipment became cleaner and safer.

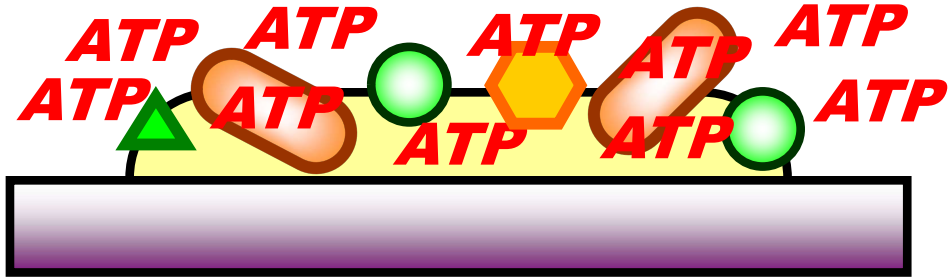
Therefore, the ATP (A3) test is useful as:
- a tool for assessing the current level of cleaning.
- a tool for changing mindset (an educational tool).

What is ATP? What is ATP test?

ATP(Adenosine TriPhosphate) is the universal energy molecule found in all living things.

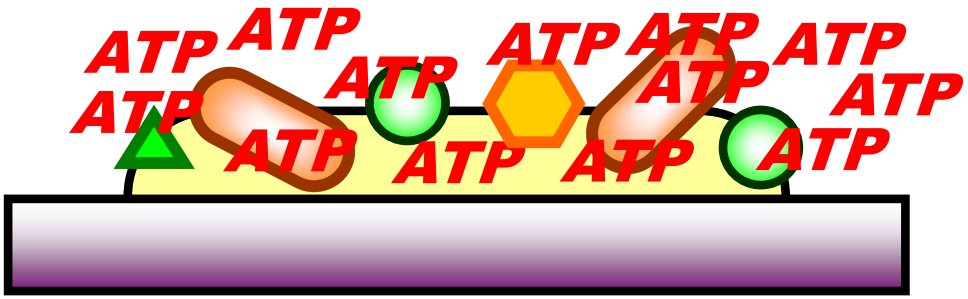


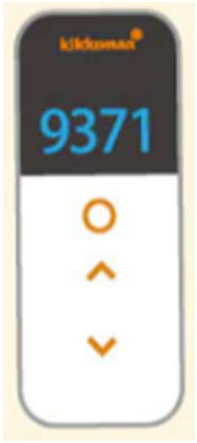
Food Residues **Microorganisms**



ATP is an indicator of cleanliness and cleaning efficacy.

What is ATP? What is ATP test?

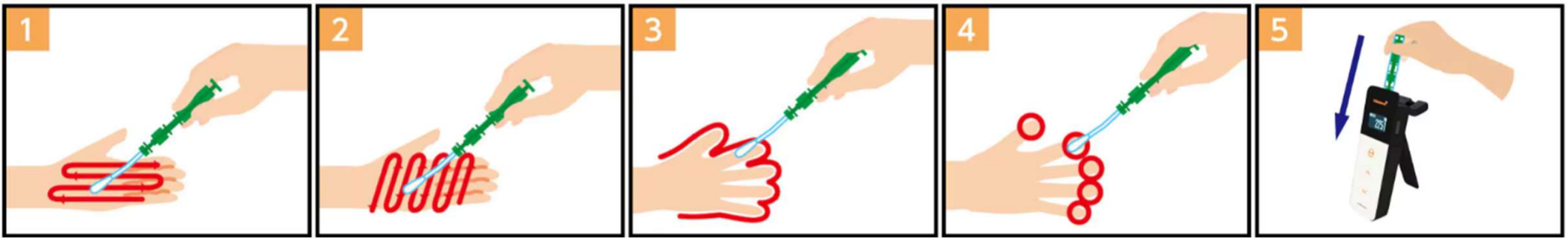




Workshop

Let’s actually experience ATP testing.

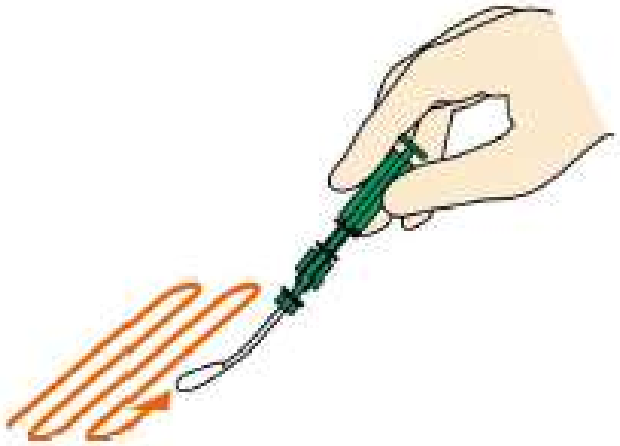
Method of swabbing – hand –

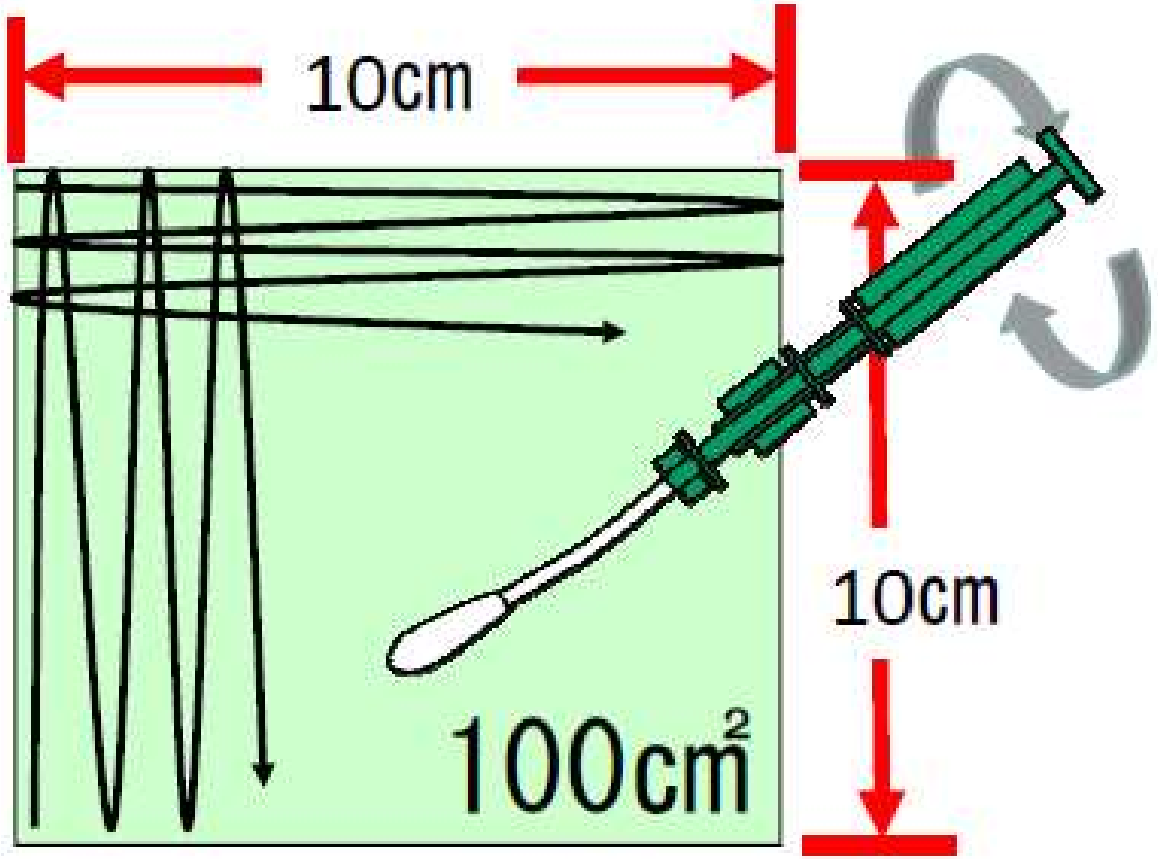


1. vertically back and forth five times
2. horizontally back and forth five times
3. swab between the fingers
4. swab the fingertips
5. shake the reagent well and measure with the Lumitester Smart

Method of swabbing – surface –

Swab 10 times vertically and horizontally with rotating.





Method of swabbing

Swab with enough pressure for the swab shaft to bend slightly.

too weak

good

too strong

Let’s go to the actual kitchen

Let’s try using ATP(A3) test in actual hygiene instruction and audits.

Have you ever had an experience like this?

You (auditor): “Are the cooking utensils being cleaned properly?”

Kitchen staff: “Of course, we clean them thoroughly.”

If you use ATP test in your audit

Your audit will become more effective and educational.

Where should ATP test be performed?

- Hands after handwashing
- Cooking utensils/equipment that frequently contact with foods (cutting boards, knives)
- Areas that are likely to be difficult to clean

How should hygiene instruction be conducted with ATP test?

- Tell the kitchen staff that you will measure the cleanliness level.
- Tell him/her that this is called an ATP test, a test method that is used around the world.
- Conduct an ATP test and have the kitchen staff observe the ATP test.
- Share the values obtained.

If a **high** value is detected:

- Tell him/her that the surface is not clean.
- Have him/her wash the item again (and you check at that time whether it is being washed properly).
- After re-washing, measure again and confirm that the value has decreased.
- Praise him/her.
- Tell him/her that you would like him/her to always wash to achieve this level of cleanliness to prevent food poisoning incidents

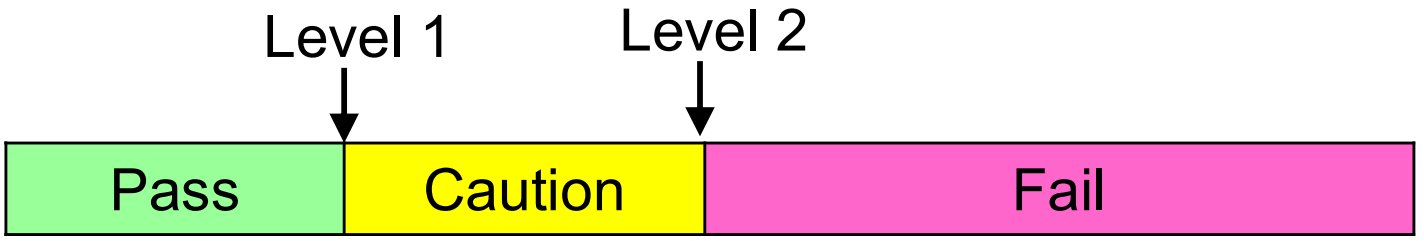
How should hygiene instruction be conducted with ATP test?

If a **low** value is detected:

- Tell him/her the surface is clean.
- Praise him/her.
- Tell him/her you would like him/her to maintain this level to prevent food poisoning incidents .

Recommended Pass/Fail limit

Materials	Pass/Fail limit	
	Level 1	Level 2
Stainless steel	200	400
Glass	200	400
Wood	500	1000
Plastic	500	1000
Rubber	500	1000



Attention : Scratching or pitting tend to increase values.

Thank you very much!