

AFCO SMART GEL

RAPID VERIFICATION OF EQUIPMENT CLEANLINESS



Traditional Microbial Testing Methods

Inadequate cleaning of food processing equipment has contributed to microbial contamination of food products, which in turned has resulted in food-borne outbreaks and the recalls of significantly large amounts of food products. Regulatory agencies, therefore, mandated that food processors conduct microbial testing on the processing equipment and food-contact surfaces to ensure the production of safe food.

The traditional methods that have been used to test surfaces prior to production are rather lengthy, which makes them very inconvenient and unpractical for food processors, mainly because many are gearing towards continuous production with the minimum amount of down time. Usually, traditional microbial testing methods that would confirm the presence or absence of pathogenic microorganisms on food processing equipment are considerably complex, expensive, and require long incubation periods (24 to 48 hours for bacteria and 4 - 5 days in the case of mold and yeast).

Rapid Verification of the Sanitary Condition of Equipment

The urgent need for rapid methods that would confirm the sanitary condition of processing equipment right after cleaning and prior to production have prompted food processors to pursue additional testing methods, including the use of automated testing equipment and rapid microbial test kits. These methods, however, are not fast enough as they require several hours of incubation to confirm the absence or presence of pathogenic microorganisms on the surfaces. Additionally, the automated testing equipment is very expensive, making it very inconvenient for many medium to small size companies to purchase.

For the above reasons, some companies have developed more advanced technologies that would significantly shorten the confirmation period between cleaning and production to a few seconds. One of the fastest, most accurate and reliable technologies in the market is AFCO's **Smart Gel** technology. **Smart Gel** can deliver confirmative test results within a few seconds of testing. Moreover, unlike other rapid methods,

Smart Gel technology can detect any type of oxidizable organic matter on

the surfaces and does not require expensive instruments and swabs like the ATP, protein, and glucose testing methods.



Why Remove All Food Residue?

Before talking about the Smart Technology, we need to answer the following question:

Why is it important that we do not leave food residue on the food processing equipment after cleaning and before sanitizing?

Scenario 1: Let's assume after cleaning, there was still some food residue (pieces or particles of meats, poultry, vegetables, etc.) left on the processing equipment. This organic residue might be harboring pathogenic microorganisms, such as Listeria, E. coli, and Salmonella, within and under them. You may be thinking, "Why should I care if I am sanitizing the processing equipment afterwards? Sanitizer should destroy all of these pathogenic microorganisms. Right?" **Wrong!**

Remember, sanitizers do not penetrate food particles, especially the larger particles. Therefore, when the sanitizer is applied on a dirty or soiled surface, the bacteria that are embedded into and under the soil (food particles) will not likely be killed by the sanitizer.

The bacteria are actually protected from the sanitizer's effect by the food particles around them. So, after sanitizing and while waiting for production to start, these protected bacteria will feed on food particles, grow, and multiply at a very high rate. (Usually in optimum conditions, bacteria will double in numbers every 20–30 minutes). The resulting high number of bacteria will then contaminate the new batch of food being produced on this processing equipment.

Scenario 2: Now, let's assume that the food processing equipment is properly cleaned, whereas no soil or food particles were left on the processing equipment. In this case, the few exposed bacteria, that are left on the surfaces after cleaning, will either die from the sanitizer (no food particles to protect them), or if they survive the sanitizer (sanitizers do not kill 100% of the microorganisms) they will then die of starvation within a couple of hours. It's for the above reasons we should not leave any food residue of any kind on the processing equipment after cleaning and before sanitizing.

Biofilm

This leads us to another food safety concern: biofilm. As you may know, biofilm is a very dangerous microbial colonization in food processing plants. It is usually made by microorganisms when they are subject to adverse environmental conditions, such as cold, heat, starvation, acidity, weak sanitizer, etc. The bacteria in a biofilm multiply rapidly and produce sticky/slimy substances called extracellular polymeric substances (EPS) which help the bacteria stick together and to the surfaces. These substances are typically a conglomeration of polysaccharides (which are complex sugars), proteins, fats, and other organic matter. Biofilm houses millions of bacteria that can be of a pathogenic nature, such as Listeria, E. coli, and Salmonella. Therefore, its presence in food processing plants represents a tremendous threat to food safety programs. Usually, biofilm can form on any surfaces, including, equipment, drains, floors, and other environmental surfaces where water and nutrients (food) are readily and continuously available for the bacteria to grow and multiply.

The three main challenges of having biofilm in a food processing plant are: 1) its ability to harbor and protect large numbers of pathogenic microorganisms that can contaminate food products, 2) its removal—the ESP compound, which makes up the majority of the biofilm's matrix, is very resistant to traditional cleaners and sanitizers. Therefore, its removal requires vigorous physical agitation or scrubbing, which can be very labor intensive and time consuming, and 3) detection—since biofilm can be very thin or invisible (as thin as a few micrometers), it is very hard to spot and detect with the naked eye.

How Smart Gel Detects Organic Matter

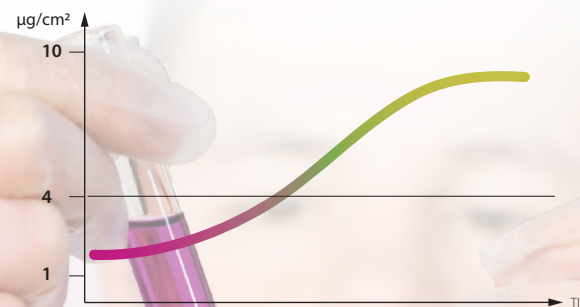
The ability to rapidly and precisely verify the presence or absence of any oxidizable organic matter on processing equipment prior to production is very important to the QC department and to reduce production down time. AFCO's **Smart Gel** is just the technology for that. This unique and patented, persulfate-based technology detects the presence of **any organic** matter, including proteins, fats, saccharides, aromas, phenol compounds, and oxalates (substances which can encourage microbial growth and the formation of biofilm) on the surfaces by means of oxidation. Most of the other rapid tests available are limited to the detection of a specific organic substance, such as glucose, lactose, protein, or even ATP.

Since the organic matter (visible and invisible) that is left on surfaces after cleaning protects microorganisms from the lethal effect of the sanitizer and encourages microbial growth and the formation of biofilm, AFCO's **Smart Gel** will be able to detect its presence, thus providing the QC department with a security alert to take a corrective action prior to production. Regardless of the visibility of the organic matter, **Smart Gel** chemistry will be able to show it by changing its color within a few seconds of application.

Colorimetric Technology

Smart Gel is a two-part product that can be easily mixed and applied via a spray bottle or a foaming device. Once mixed, the final mixture color is purple. Within a few seconds of application, if the gel changes color from purple to green, it's an indication that the surface is not clean; therefore, it requires recleaning. But, if the color stays purple, it means the surface is clean and free of any organic matter, and is thus ready to be sanitized.

Smart Gel technology is based on a manganometric measuring principle in an alkaline environment. When in contact with organic residue, it oxidizes and decomposes the organics to their mineral ingredients and at the same time, reduces the indicator of manganese 7 to manganese 2 (called the redox principle), which is the reason for the color change of the gel.



A clearly visible green color is produced by Bovine serum albumin at ~ 5–7 µg/cm² and Glucose at ~ 1–2 µg/cm²



Sensitivity of Smart Gel

Smart Gel technology is the quickest and most sensitive test in the market today as it visually detects 1-2 µg/cm² of glucose and 5 µg/cm² of albumin. Therefore, it is 10-100 times more sensitive than protein, glucose, and ATP tests, as proven by testing the four food groups listed in the table below.

Sensitivity Analysis

FOOD *	PROTEIN TESTS*	GLUCOSE TESTS*	ATP BIO-LUMINESCENCE*	SMART GEL **
Dairy products	1/20	1/100	1/100 – 1/1000	1/1000 – 1/10000
Lemonade	not detectable	1/1000	1/1000	1/10000
Sausage	1/10	1/10	1/100	1/100 – 1/1000
Ketchup	1/10	1/10000	1/100	1/10000

* The comparative data was collected from vendors and sales literature and is available upon request.

** The dilution was applied to a 1cm² area, dried and then sprayed with SMART GEL.

Smart Gel Benefits and Advantages

- Excellent tool for pre-op inspection
- Shows results within a few seconds
- Very sensitive in detecting low amounts of organic matter
- Detects all types of organic matter, unlike other rapid testing methods
- Safe for use on food contact surfaces
- No expensive instruments or swabs are needed for testing
- Easy to mix and apply
- Economical, especially for large-scale operations
- Can be used on a much larger surface than other testing methods (for example ATP)
- More economical than other testing methods
- For use in all types of food processing plants including organic plants
- Rinses freely off of surfaces
- Helps indicate the presence of allergens as part of the organic soil left on surfaces
- Supports a HACCP verification program

Food processing equipment is not the only place **Smart Gel** can be useful, it's also suitable for use on all environmental surfaces, including floors, walls, sink, drains, etc.

Take advantage of this simple yet powerful tool to ensure the production of safe food on sanitary equipment.

For more information about **Smart Gel** please contact an AFCO representative in your area. For a **Smart Gel** demonstration video please visit: www.youtube.com/watch?v=f_qE-KFPp0E.

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