**Hypothesis:**

Dycem mat is capable to reduce the shoe-born biological contamination before entering the production site.

**Objective:**

Analyze the microbial and ATP count to validate the capability of the Dycem mat to reduce cross-contamination.

**Responsibility:**

QA Team

**Equipment:**

ATP swabs, Swabs for Microbiology tests, ATP measuring unit (Luminometer), Dycem mat.

Day 1 and 2 – Dycem mat was placed entrance to the Meal Assembly

Day 3 to 10 - Dycem mat was placed on Test Kitchen Floor due to safety reason

**Method:**

* Before a staff member walks on the Dycem mat, QA collected the swab from footwear that touches the floor.
* A staff member walks 3 to 5 steps on the Dycem mat.
* QA collected the swabs from the same footwear after walking on the Dycem mat(before stepping on the floor).
* Daily Dycem mat was cleaned with Non-chlorinated (Chemical name: Caustekfree) soap and sanitized (Chemical name: Eco gel and Surfan)

**Note:**

Indoor footwear can use only for production sites.

Before walking on the Dycem mat, staff members walked on the production site floor (Corridors, Test Kitchen, Kitchen, Preparation, Storage, Boxing, Receiving, Shipping, label room, Supervisor’s room, and Coat and Boot room).

**Data collection:**

* Data collected for two weeks.
* Ten days of collected ATP swabs were prepared to analyze the impact on biological cross-contamination (biological concentration and health -ATP).

Seven days of collected microbial swabs were prepared to analyze the impact on specific microorganisms such as *E. coli., Total Coliform coun,t and Staphylococcus aureus.*

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**Results:**

ATP test results (Table 1.1), *E. coli test results* (Table 1.2), *Total Coliform count* results (Table 1.3) *Staphylococcus aureus* (Table 1.4)

**Results analysis:**

**Figure1.1 -Analysis of ATP test results**

There is a significant ATP results reduction after walking on the Dycem mat. According to the ATP swab results taken after walking on the Dycem mat, 100% of results is lower than the ATP results taken before walking on the Dycem mat.

**Figure1.2 -Analysis of *E. coli* test results**

Based on the results of the *E. coli* analysis, there is no microbial growth before and after walking on the Dycem mat.

**Note: Still waiting for day 5 lab results.**

**Figure1.3 -Analysis of *Total coliform* count results test results**

According to the above results of the *Total coliform* count analysis, there is no microbial growth before and after walking on the Dycem mat.

**Note: Still waiting for day 5 lab results**

**Figure1.3 -Analysis of** *Staphylococcus aureus* **count results test results**

According to the above results of the *Staphylococcus aureus* count analysis, there is no microbial growth before and after walking on the Dycem mat.

**Note: Still waiting for day 5 lab results**

**Conclusion:**

According to figure 1.1, there is a significant reduction of biological energy present on footwear after walking on the Dycem foot mat. Biological energy shows the presence of microbes and/or resources to grow microbes like food residue. Therefore, it concludes that Dycem mat is capable to reduce the biological cross-contamination on footwear to ensure a safe non-food contact environment in the production site.

Based on specific microbiology analysis (*E. coli. and Total Coliform and Staphylococcus aureus )* results, there is no quantitative reduction of microbial growth before and after walking on the Dycem mat. *E. coli. and Total Coliform* common types of bacteria that indicate the sanitary condition of the non-food contact environment of the production site. Figures 1.2,1.3 and 1.4 illustrate both results are lower than the detectable limit (RDL <10 CFU). Therefore, it concludes that the footwear that staff uses in the production sites has no risk of contamination by *E. coli., Total Coliform, and Staphylococcus aureus.*

Finally, Dycem mat is capable to reduce biological contamination, and apetito HFS sanitary conditions are satisfactory to ensure that the non-food contact environment (Floors and footwear) is properly controlled.

**Literature:**

According to research findings, a molecule is found only in and around living cells, and as such it gives a direct measure of biological concentration and health. ATP is quantified by measuring the light produced through its reaction with the naturally occurring firefly enzyme luciferase using a luminometer. The amount of light produced is directly proportional to the amount of biological energy present in the sample. Within a water sample containing microorganisms, there are two types of ATP:

* [Intracellular](https://en.wikipedia.org/wiki/Intracellular) ATP – ATP contained within living biological cells.
* [Extracellular](https://en.wikipedia.org/wiki/Extracellular) ATP – ATP located outside of biological cells that have been released from dead or stressed organisms.

Accurate measurement of these two types of ATP is critical to utilizing ATP-based measurements. (<https://meridian.allenpress.com/jfp/article/81/5/729/175086/Development-of-a-Novel-Hygiene-Monitoring-System>)

Many strains **of E. coli** are harmless to humans, but some can cause serious illness. Most cases of foodborne illness are caused by a strain known as E. coli O157. E. coli O157 is often passed on through raw and undercooked meats. It can also be spread through other contaminated foods, such as vegetables and salads, water, or unpasteurized milk. ( [E. coli | Food Standards Agency](https://www.food.gov.uk/safety-hygiene/e-coli)).

**Coliform bacteria**, a group of closely related bacteria found in soil, water, and the intestinal tract of animals, have been used as indicators of unsanitary conditions in food and beverage production for more than a century, including tests for water and dairy products originating in the early 1900s. Today, the coliform count is a frequent hygienic indicator in several food and beverage industries.( [www.3m.com/3M/en\_US/food-safety-us/resources/microorganisms/coliform/](http://www.3m.com/3M/en_US/food-safety-us/resources/microorganisms/coliform/))