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Report

Cleaning with less water

Ultraviolet light inspection with Bactiscan

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Background

In the food industry, visual inspection is the primary method used to evaluate cleanliness of the equipment.

Food residues on equipment or hard-to-reach areas can be difficult to detect when large production sites are assessed after the daily cleaning. If the organic material is not properly removed, it poses a risk as it allows bacterial biofilm to be formed.

A tool for rapid visualization of food soil and bacterial biofilm on surfaces and equipment could be of interest for the meat industry, as large areas could be inspected quickly.

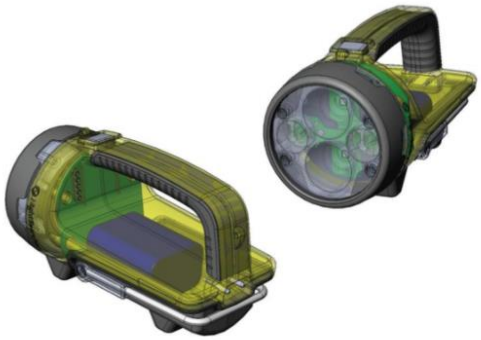

Figure 1. Bactiscan UV lamp. Figures from food-supply.dk

Bactiscan is a handheld ultraviolet (UV) lamp. UV-light causes some types of organic material to fluoresce, making these types of contaminations easier to detect during visual inspection.

The manufacturer of Bactiscan states that both food residues, high concentrations of bacteria/yeast and a well-established biofilm on equipment or surfaces can be visualized using the device.

Bacterial clusters and biofilm should be evident as a green or turquoise spots on the contaminated surface, while food residues or dust should be evident as blue spots.

Aim

The aim of these testes is to evaluate the usefulness of the Bactiscan instrument as a tool for detecting food soil and bacterial biofilm.

Method and results

Laboratory

Biofilm formation

Various surfaces were soiled with a suspension of either minced pork or canned cooked meat (Jaka bov) inoculated with known meat spoilers: Pseudomonas (DMRICC 4760) and Brochotrix (DMRICC 4613). These bacteria were selected as a previous study showed that strong to medium light fluorescence was observed for these species (Campden BRI, 2020). The soiled surfaces were incubated at 12°C and at 98% RH for 11 days (Figure 2).

Figure 2. Soiled surfaces with meat suspensions inoculated with bacterial spoilers. All surfaces were incubated for 11 days for biofilm formation.

The contaminated surfaces were assessed using Bactiscan before and after cleaning (Figure 3). The results were supplemented with microbiological analysis. Blue and green spots as well as areas with no visible spots were swabbed using sterile gauze swabs. The results are shown in Figure 3 (UV inspection) and Table 1(microbiological analysis).

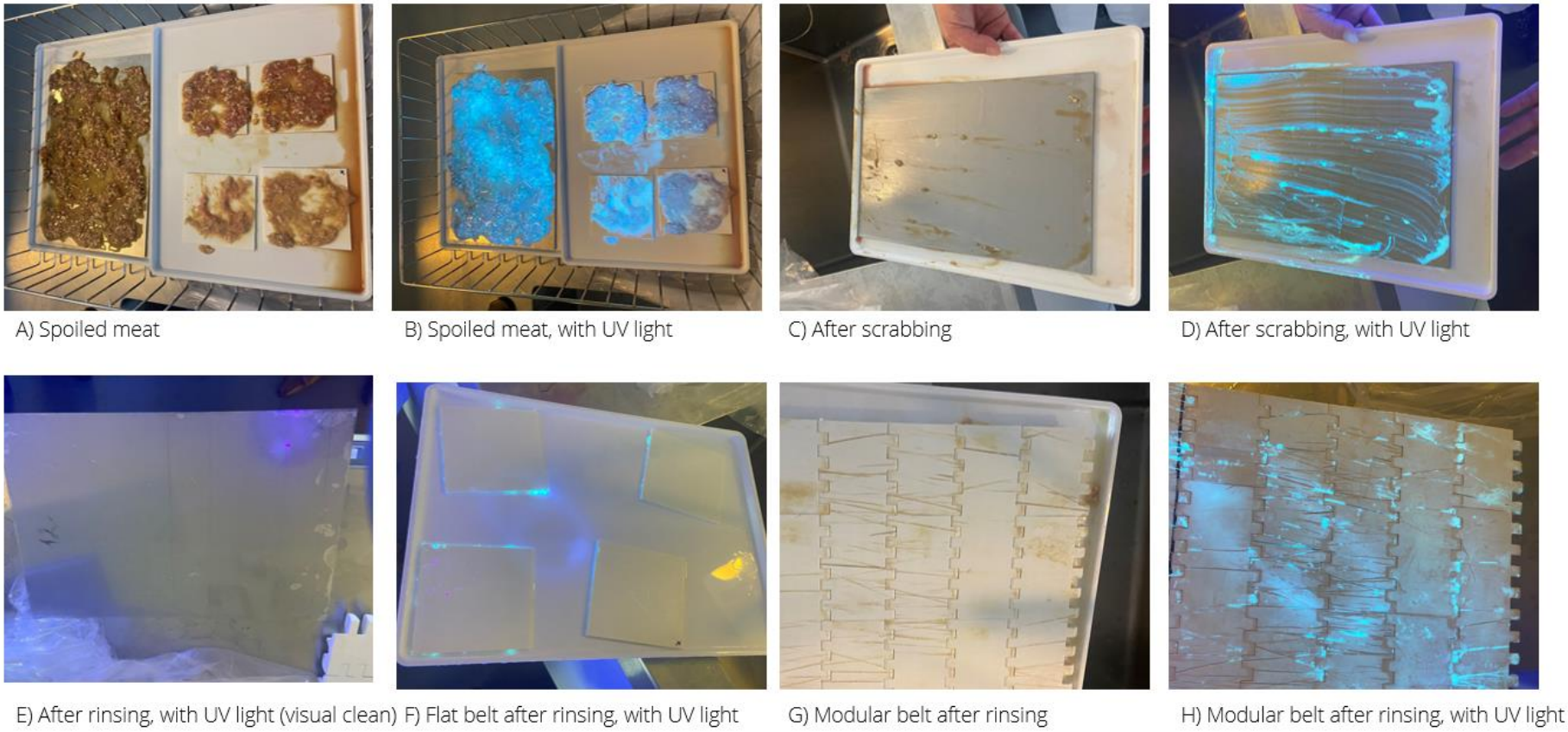

Figure 3. Surfaces contaminated with spoiled meat. Before and after cleaning with and without UV light.

Table 1. Microbiological results of the swabbed areas (log cfu/sample). Green spots should indicate high bacterial contamination or limescale. Blue spots should indicate fluorescent food material or dust. No spots should indicate cleaned areas or low level of contamination.

Steel surfaces with spoiled meat	Fluorescence	Log cfu/sample
After scrabbing	Green spot (Fig. 3C and 3D)	6.9
After rinsing with water	No fluorescence (Fig. 3E)	5.5
Modular belt with spoiled meat		**Log cfu/sample**
After rinsing with water	Blue spot (Fig. 3H)	3.4
Flat belt with spoiled meat (Fig. 3F)		**Log cfu/sample**
After rinsing with water	Green spot/lines in crevice (no picture)	6.9
After rinsing with water	No fluorescence (Fig. 3F)	6.2
Others		**Log cfu/sample**
Surface with limescale	Green spot (no picture)	1.7
Surface with limescale	Blue spot (no picture)	2.0

Result of laboratory test

The laboratory test shows that the Bactiscan makes dirty surfaces easily detectable. However, it does not create fluorescence on surfaces that are visibly clean even though they have a large bacterial load (Fig. 3E, Fig. 3F and Table 1). No clear correlation appears between fluorescence and the bacterial plate count (Table 1).

Detection of meat

The Bactiscan was also tested on meat and blood. Fresh blood and minced meat did not fluoresce, only small bits of cartilage in the minced meat lid up (Fig. 4A and B). In contrast, residues from the minced meat and dried meat did fluoresce in the UV light from the Bactiscan (Fig. 4C and D). It is possible that the high water content of fresh meat and blood prevents reflection of the UV light.

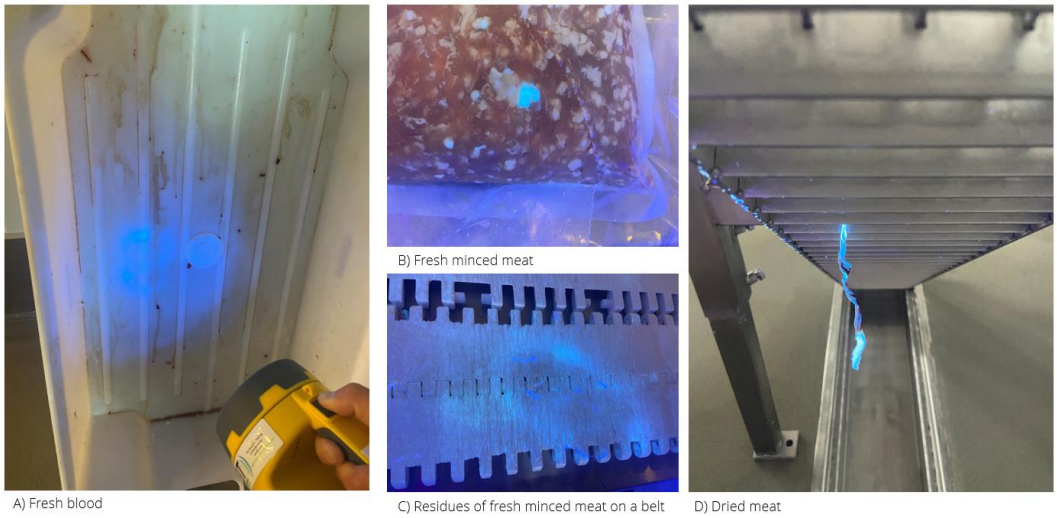

Figure 4. UV- inspection of fresh meat and blood (a,b,c) and dries meat (d).

DMRI pilot plant

Visual inspection of DMRI pilot plant using Bactiscan

The Bactiscan lamp was also tested in DMRI's pilot plant. After the usual cleaning inspection, an extra inspection was performed with the Bactiscan.

The lamp worked well with the lights on during inspection. This is not the case with traditional UV-light, which requires a semi-dark room to produce visible fluorescence.

The Bactiscan helped discover several areas with insufficient cleaning that had been overlooked in the usual visual inspection without aids (Fig. 5). It was especially the underside/backside of the equipment (Fig. 5A, B, E, F, K and L) and on the floor below the equipment (Fig. 5C and D) that insufficient cleaning was discovered during the extra inspection with the Bactiscan. In all these instances, the contaminants were also visible without the UV light, but it had none the less been overlooked in the usual visible inspection. In contrast, the vacuum packer was visibly clean, but showed a strong fluorescence (Fig. 5I and J), and a swap revealed a high plate count (Table 2).

Table 2. Microbiological results of swabbed area in DMRI pilot plant (log cfu/sample).

Area	Log cfu/sample
The underside of an equipment (Fig. 5A)	2.7
Floor below equipment (Fig. 5C)	3.3
Blade (Fig. 5E)	1
Tiles (Fig. 5G)	1.7
Vacuum packing machine (Fig. 5I)	4.1
Vacuum tap and pipe (Fig. 5K)	2.9
Sausage clipper/clipping machine	1
Door frame	4.3
Smoke oven	1.7

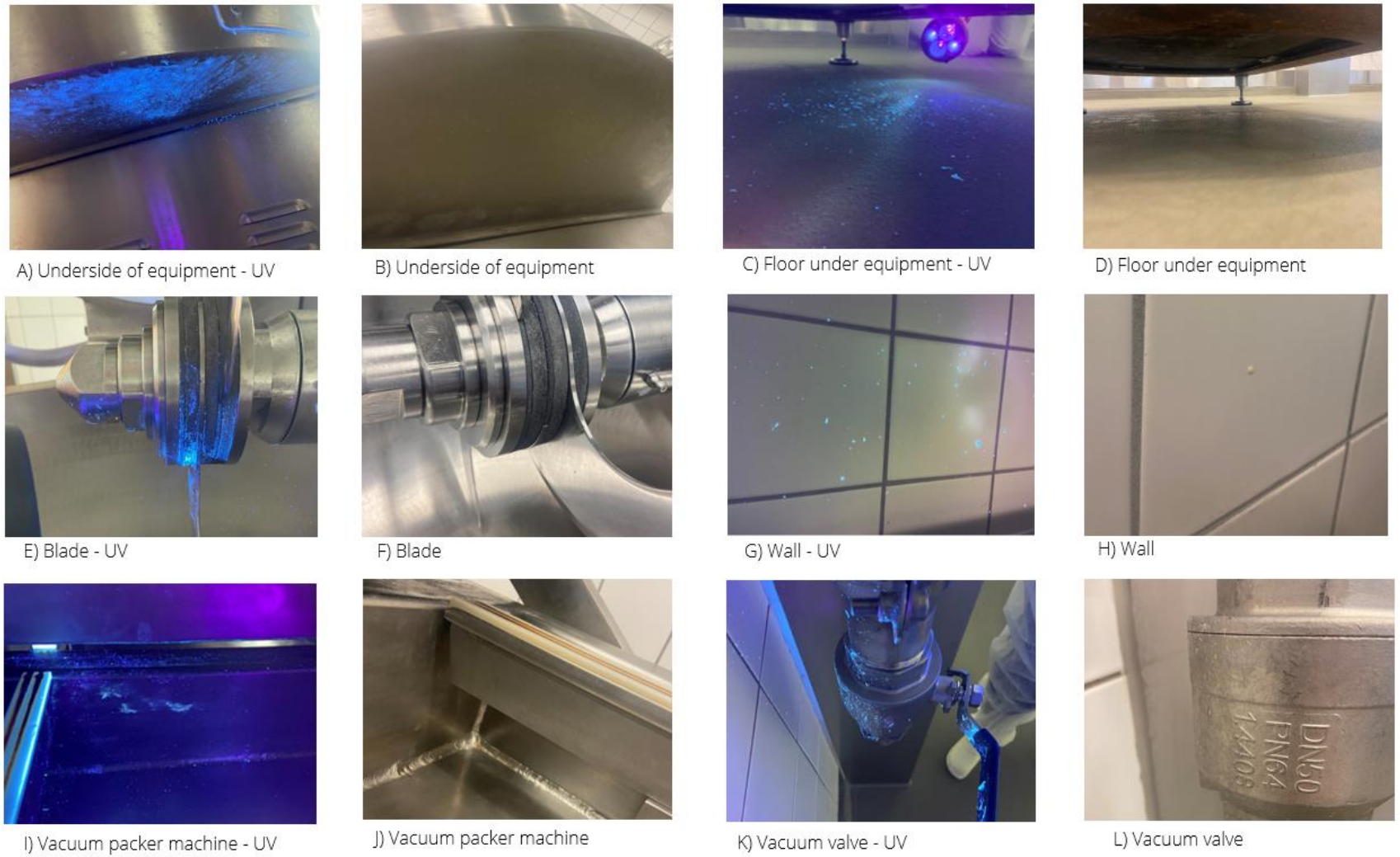

Figure 5. UV-inspection of DMRI pilot plant

The test in DMRI's pilot plant showed that the Bactiscan was very user-friendly and helped discover dirty surfaces that had otherwise been over-looked.

Conclusion

DMRI finds that the Bactiscan lamp offers several advantages. It is very user-friendly and works in well-lid rooms. When inspecting large production sites after cleaning, food residues in corners and below equipment can easily be overlooked. With the Bactiscan lamp, organic residues become much easier to detect, and inspectors will thus be less likely to overlook insufficient cleaning.

The fluorescence also makes it easier to make pictures of the soiled areas and thus communicate where the trouble-areas are to the cleaning staff. Bactiscan also offers a camera that can be attached directly to the lamp.

Though the Bactiscan lamp seems a useful tool during cleaning inspections, there does not appear to be a correlation between fluorescence and bacterial plate count (Table 1). Thus, the Bactiscan will be very helpful in discovering areas with insufficient cleaning, but fluorescence cannot be directly translated to bacterial growth.

References

Campden BRI (2020), A*ssessment of Bactiscan instrument for detection of food industry biofilms,* 11th November 2020.