Introduction:
The hygiene of food contact surfaces is critical to ensure the safety and quality of foods. The use of surface ATP hygiene monitoring systems is widespread and provides food business operators with rapid, measurable and cost effective tests. This enables them to take corrective actions in a timely manner and improve surface hygiene. Therefore, it is essential that the ATP hygiene monitoring system provides accurate, reliable, consistent and repeatable results.

Methods:
The performance of the luminometers and ATP test devices was evaluated at 5°C, 10°C, 20°C and 35°C using an environmental chamber. All devices were tested by pipetting 10µl of a 4 x 10^8 M ATP solution onto the mid-section of the swab/sponge bud of each device. Testing was completed following the instructions provided by the device manufacturer. The repeatability was assessed by calculating the Coefficient of Variance (%CV).

Results:
The results of the repeatability experiment are illustrated below:

Table 1 – Repeatability (%CV when read at 0 Seconds)

<table>
<thead>
<tr>
<th>Hygiene Monitoring System</th>
<th>5°C</th>
<th>10°C</th>
<th>20°C</th>
<th>35°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M Clean-Trace Surface ATP Test System</td>
<td>18.01%</td>
<td>19.87%</td>
<td>11.33%</td>
<td>12.58%</td>
</tr>
<tr>
<td>Biocontrol LIGHTNING MVP ICON ATP Test System</td>
<td>49.19%</td>
<td>31.69%</td>
<td>34.02%</td>
<td>47.08%</td>
</tr>
<tr>
<td>Charm PocketSwab Plus ATP Test System</td>
<td>20.58%</td>
<td>25.53%</td>
<td>31.33%</td>
<td>32.78%</td>
</tr>
<tr>
<td>Hygiena SuperSnap ATP Test System</td>
<td>24.96%</td>
<td>27.76%</td>
<td>16.91%</td>
<td>20.27%</td>
</tr>
<tr>
<td>Hygiena UltraSnap ATP Test System</td>
<td>50.92%</td>
<td>47.53%</td>
<td>19.66%</td>
<td>21.24%</td>
</tr>
<tr>
<td>Kikkoman LuciPac Pen ATP Test System</td>
<td>28.72%</td>
<td>32.93%</td>
<td>36.40%</td>
<td>19.35%</td>
</tr>
<tr>
<td>Neogen Accupoint ATP Test System</td>
<td>86.44%</td>
<td>83.90%</td>
<td>61.53%</td>
<td>49.90%</td>
</tr>
</tbody>
</table>

Colour Key: Acceptable | Unacceptable

Graph 1 - Coefficient of Variance (%CV)

Discussion:
The repeatability of the various hygiene monitoring systems was assessed on the Coefficient of Variance (%CV) of the results of the ten repeat samples. The %CV was calculated based on the mean RLU readings immediately after activation (0 seconds) with a n=10 at each temperature point. A threshold of 20% CV was used to categorise the surface ATP test systems into ‘Acceptable’ and ‘Unacceptable’ categories. The results indicate that the 3M Clean-Trace Surface ATP Test System provided the most consistent and repeatable RLU readings; consistently achieving <20 %CV at all temperatures. 3M Clean-Trace surface ATP test also achieved the lowest overall %CV (11.33%) at 20°C.

The 20°C readings of the Biocontrol LIGHTNING MVP ICON (%CV = 34%), Charm Pocket Swab Plus (%CV = 31%), Kikkoman Lucipac Pen (%CV = 36%) and Neogen Accupoint (%CV = 62%) ATP test systems results were inconsistent. Inconsistent readings could lead to misinformed decisions at the cleaning verification stage, which could directly impact hygiene and manufacturing efficiencies. Therefore, in order to ensure a consistent reliable result, the selection of the most appropriate surface ATP test kit is essential.

The use of surface ATP test systems which had poor repeatability could lead to highly inaccurate and unreliable results. ‘False positive’ or ‘False negative’ results are more likely to be obtained for products which demonstrate poor repeatability. Re-cleaning of surfaces, which have been inaccurately identified as ‘contaminated,’ could needlessly be completed. Conversely, if an inaccurate low result is obtained, food production lines could be authorised to start up when the surfaces do not meet the specified hygiene standard.

It is of paramount importance that hygiene monitoring systems provide a repeatable result to ensure consistency and accuracy of data. Effective and accurate surface assessment can be used for optimisation of sanitation procedures, process efficiency and continual improvement of plant hygiene standards.

References:

Significance: There are considerable differences between the repeatability performances of the brands; it is essential that hygiene monitoring systems provide a repeatable result to ensure consistency and accuracy of data. Effective and accurate surface assessment can be used for optimisation of sanitation procedures and continual improvement.

Acknowledgement:
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