IMSL

INDUSTRIAL MICROBIOLOGICAL SERVICES LTD

STUDY REPORT:	**Determination of the Antibacterial Activity of an Antimicrobial Plastic Door Handle against *Escherichia coli*, Methicillin-resistant *Staphylococcus aureus* (MRSA) and *Salmonella typhimurium* using ISO 22196 : 2011**
	Plastic Door handles
CLIENT:	**Titan Healthcare Products** **375 Babbacombe Road** **Torquay** **Devon** **TQ1 3TB** **UK**
REPORT NO:	**IMSL 2016/04/008.3A-1**
DATED:	**29th July 2016**

Study: Determination of the Antibacterial Activity of an Antimicrobial Plastic Door Handle against *Escherichia coli*, Methicillin-resistant *Staphylococcus aureus* (MRSA) and *Salmonella typhimurium* using ISO 22196 : 2011

Number: IMSL 2016/04/008.3A-1

Client: Titan Healthcare Products
375 Babbacombe Road
Torquay
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UK

The above study was conducted in the laboratories of Industrial Microbiological Services Ltd at Pale Lane Hartley Wintney, Hants, RG27 8DH, UK. This report represents a true and accurate account of the results obtained.

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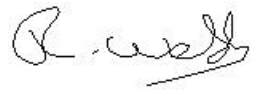

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1 Introduction

This report summarises a study performed to assess the antibacterial performance of an injection moulded plastic door handle against *Escherichia coli*, Methicillin Resistant *Staphylococcus aureus* (MRSA) and *Salmonella typhimurium* using ISO 22196 : 2011 with a reduced contact time.

2 Test Materials

Samples of injection moulded plastic door handles fortified with an antibacterial additive were supplied by Titan Healthcare Products. A sample of unfortified polypropylene was supplied by IMSL to act as a reference material. All samples were held in the dark at 20°C prior to testing.

3 Methods

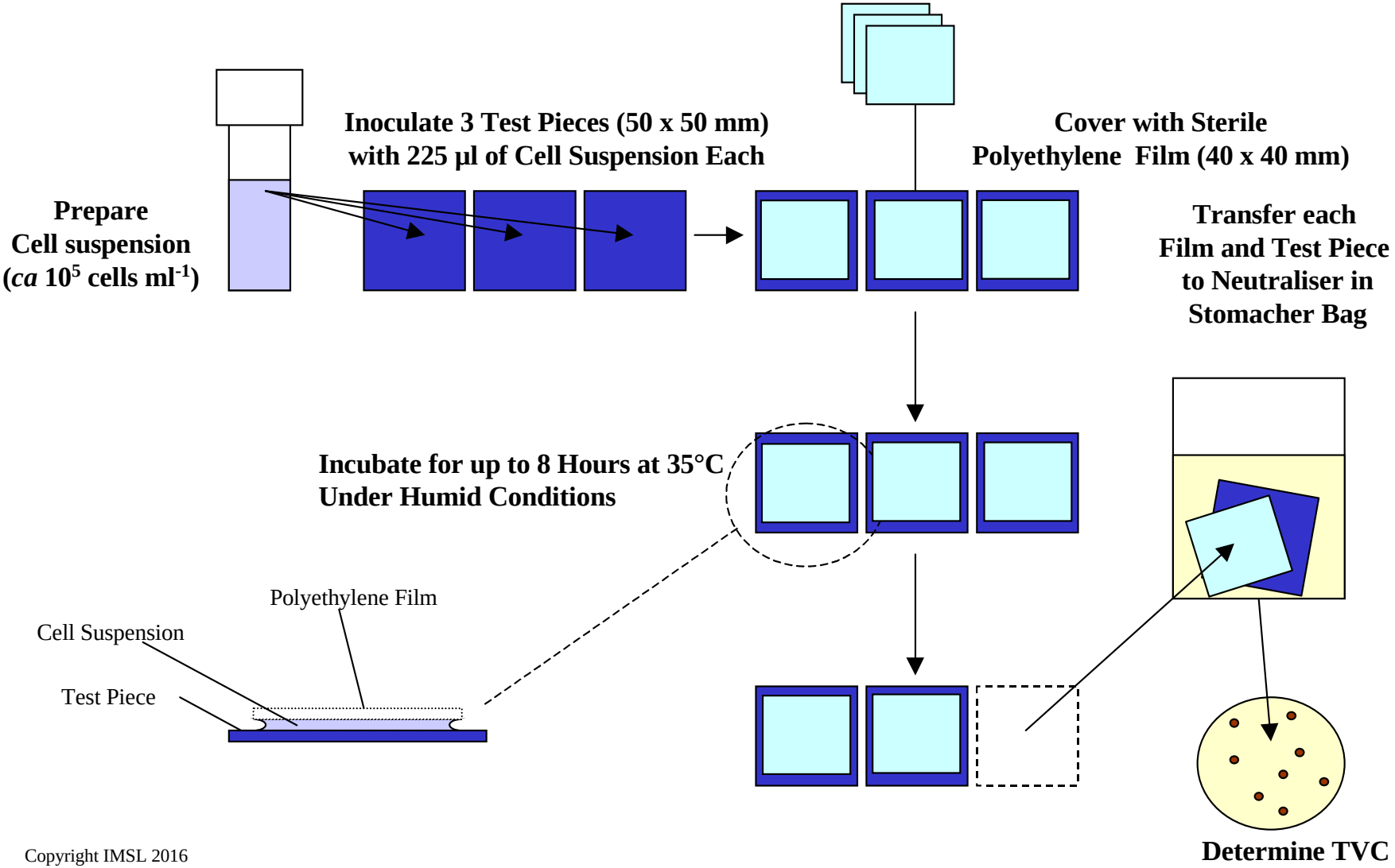
Antibacterial activity was determined using the method described in ISO 22196 : 2011 (Ref 1) using contact intervals of 1, 4 and 8 hours.

3.1 Determination of Antibacterial Activity

An aliquot (225µl) of a log phase cell suspension of either *Escherichia coli* (4.5×10^5 cells ml^{-1}; ATCC 8739), MRSA (4.4×10^5 cells ml^{-1}; NCTC 12493) or *Salmonella typhimurium* (4.6×10^5 cells ml^{-1}; ATCC 14028) prepared using the method described in ISO 22196 were held in intimate contact with each of 3 replicates of the test surfaces supplied using a 30 x 30 mm polyethylene film (cut from a sterile Stomacher bag) for 24 hours at 35°C. The size of the surviving population was determined using the method described in ISO 22196 The viable cells in the suspension were enumerated by spiral dilution on to Trypcase Soya Agar and by the pour plate method described in ISO 22196. These plates were then incubated at 35°C for 24 hours and then counted. An additional 3 replicate unfortified surfaces were also inoculated in the manner described above but were then analysed immediately for the size of microbial population present to provide 0-time control data. The method is described schematically in Figure 1 below.

All data were converted to colony forming units (CFU) cm^{-2} and then transformed (Log10) to provide a data set that conformed to a Gaussian distribution. Potential outliers were tested using Dixon's *Q*-test (P = 0.05).

Figure 1: ISO 22196 : 2011 - Schematic Representation



4 Results / Discussion

The results are shown in Tables 1 - 3 and Figure 2 below.

Table 1: Activity of Material Against *Escherichia coli* (Geometric Mean of 3 Replicates as Colony Forming Units cm^{-2})

Sample	Contact Time			
	0 hours	1 hour	4 hours	8 hours ‡
Polypropylene	2.0×10^4	1.3×10^4	2.4×10^4	5.8×10^4
Door Handle	2.0×10^4	2.8×10^3	7.0×10^0	≤ 1.0

‡ The theoretical limit of detection is 1 CFU cm^{-2}

It can be seen from the results above that the population of *Escherichia coli* held in contact with the IMSL Polypropylene reference material gradually increased in size by up to 0.5 orders of magnitude during the 8 hour contact interval compared to the initial population. This is considered a normal response for this species on an inert surface under the conditions imposed by ISO 22196.

In contrast, the populations of *Escherichia coli* exposed to the surfaces of the Door Handle sample declined by 0.9 orders of magnitude after 1 hour, 3.5 orders of magnitude after 4 hours and by $\geq$ 4.4 orders of magnitude to below the limit of detection after 8 hours compared to the initial population.

Table 2: Activity of Material Against MRSA (Geometric Mean of 3 Replicates as Colony Forming Units cm^{-2})

Sample	Contact Time			
	0 hours	1 hour	4 hours	8 hours ‡
Polypropylene	2.5×10^4	9.1×10^3	6.9×10^3	7.5×10^3
Door Handle	2.5×10^4	9.2×10^3	4.5×10^1	≤ 1.0

‡ The theoretical limit of detection is 1 CFU cm^{-2}

The population of MRSA held in contact with the IMSL Polypropylene reference material declined by 0.5 orders of magnitude compared to the initial population after 8 hours. This level of reduction is again considered a normal response for this species on an inert surface under the conditions imposed by ISO 22196.

The populations of MRSA exposed to the surfaces of the plastic Door Handle declined by 0.4 orders of magnitude after 1 hour, 2.7 orders of magnitude after 4 hours and by $\geq$ 4.4 orders of magnitude to below the limit of detection after 8 hours compared to the initial population.

Table 3: Activity of Material Against *Salmonella typhimurium* (Geometric Mean of 3 Replicates as Colony Forming Units cm^{-2})

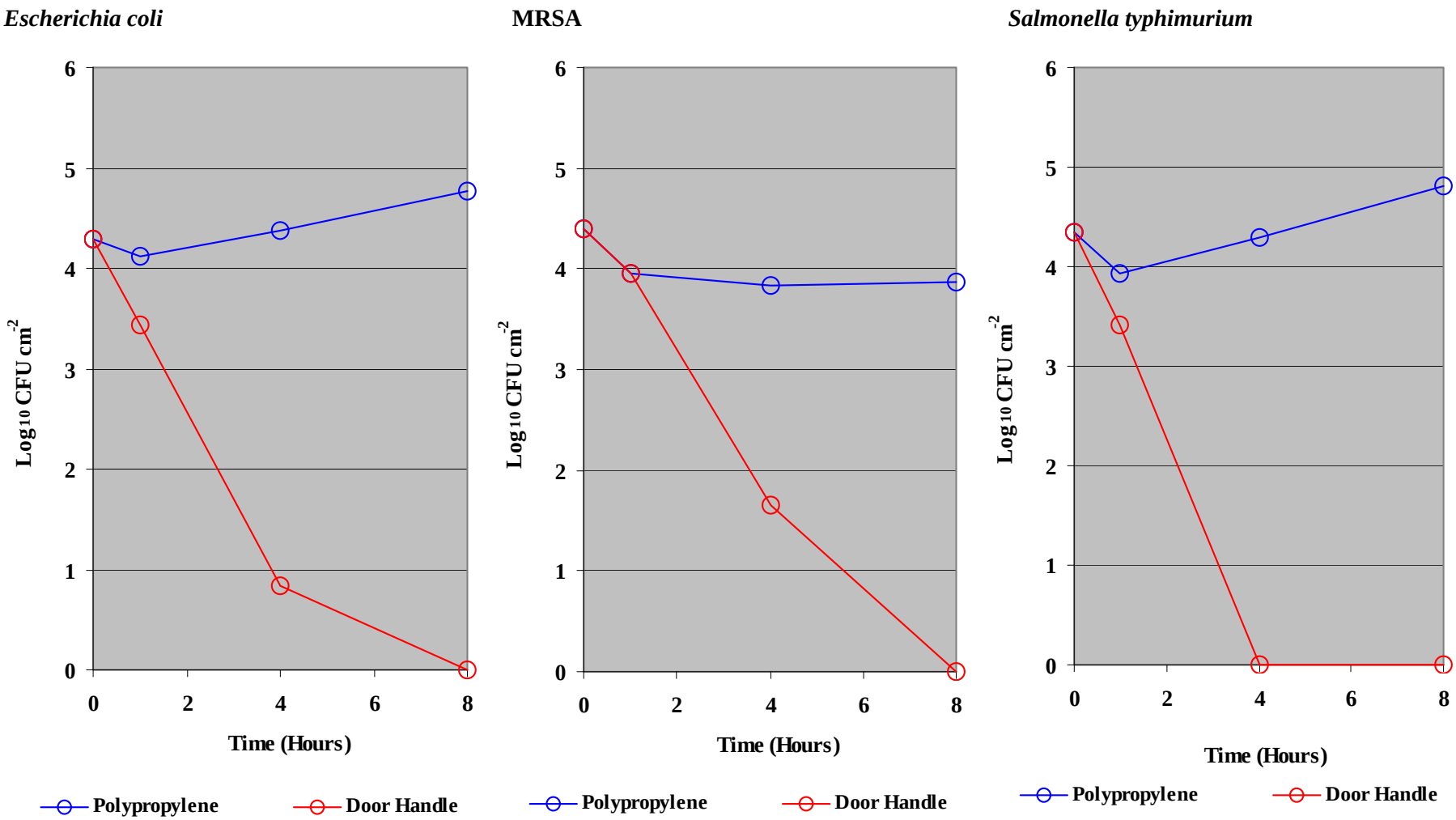
Sample	Contact Time			
	0 hours	1 hour	4 hours	8 hours ‡
Polypropylene	2.2×10^4	8.5×10^3	2.0×10^4	6.5×10^4
Door Handle	2.2×10^4	2.6×10^3	≤ 1.0	≤ 1.0

‡ The theoretical limit of detection is 1 CFU cm^{-2}

The population of *Salmonella typhimurium* held in contact with the IMSL Polypropylene surface showed an initial decline of 0.4 orders of magnitude after 1 hour and then the population recovered and increased by 0.9 orders of magnitude during the following 7 hours. This increase is again considered a normal response for this species on an inert surface under the conditions imposed by ISO 22196.

In contrast, the populations of *Salmonella typhimurium* exposed to the surfaces of plastic Door Handle declined by 0.9 orders of magnitude after 1 hour and by ≥ 4.3 orders of magnitude to below the limit of detection after 4 and 8 hours compared to the initial population.

Figure 2: Results as Log_{10} CFU cm^{-2}



5 Raw Data

The raw data for this study will be held in file IMSL 2016/04/008 in the Archive of IMSL at Pale Lane, Hartley Wintney, Hants, RG27 8DH, UK for 6 years from the date of this report unless other specific instructions are given.

6 References

1 ISO 22196: 2011, Measurement of antibacterial activity on plastics and other non-porous surfaces.

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