

# IMSL

INDUSTRIAL MICROBIOLOGICAL SERVICES LTD

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**STUDY REPORT:**     **Determination of the Antibacterial Activity of Polymer Formulations  
against *E coli* and *Staph aureus* using ISO 22196:2007**

**Treated Shower Heads**

**CLIENT:**            **Challis Water Controls**

**REPORT NO:**        **IMSL 2009/11/010.1A**

**DATED:**             **7<sup>th</sup> February 2010**

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## **1 Introduction**

This report summarises a study performed to assess the antibacterial performance of a treated shower head against *Escherichia coli* and *Staphylococcus aureus* using the method described in the ISO22196 : 2007.

## **2 Test Materials**

Samples of shower heads which had been prepared using an antibacterial agent were supplied by Challis Water Controls. All samples were held in the dark at 20°C prior to testing. A sample of unfortified polypropylene was supplied by IMSL to act as a reference material.

## **3 Methods**

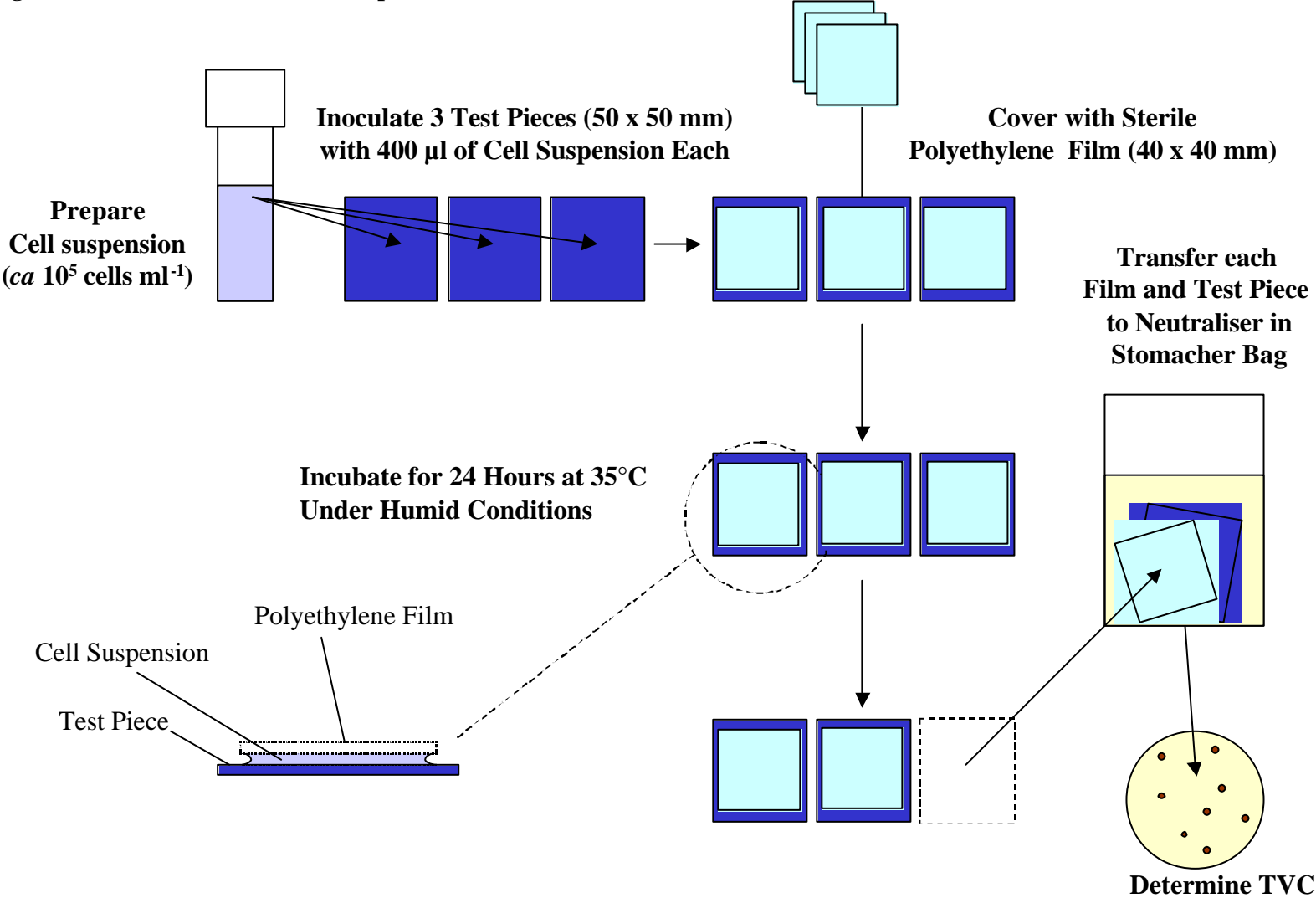
Antibacterial activity was determined using the method described in ISO22196 : 2007 (Ref 1).

### **3.1 Determination of Antibacterial Activity**

An aliquot (225µl) of a log phase cell suspension of either *E coli* ( $4.7 \times 10^5$  cells ml<sup>-1</sup>; ATCC 8739) or *Staph aureus* ( $5.0 \times 10^5$  cells ml<sup>-1</sup>; ATCC 6538p) prepared using the method described in ISO22196 was 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 ISO22196. The viable cells in the suspension were enumerated by spiral dilution on to Trypcase Soya Agar and by the pour plate method described in ISO22196. 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<sup>-2</sup> and then transformed to provide a dataset that conformed to a gaussian distribution. Confidence intervals (95%) of the means were calculated and are displayed as box and whisker plots.

**Figure 1: ISO22196 - Schematic Representation**



#### 4 Results / Discussion

The results are shown in Tables 1 - 2 and Figure 2. The confidence intervals of the data are shown in Figure 3.

**Table 1: Activity Against *E coli***  
(Geometric Mean of 3 Replicates as Colony Forming Units cm<sup>-2</sup>)

Sample	Contact Time	
	0 hours	24 hours
Polypropylene	1.6 x 10 <sup>4</sup>	1.8 x 10 <sup>5</sup>
Shower Head	1.6 x 10 <sup>4</sup>	< 1.0

‡ The theoretical limit of detection is 1 CFU cm<sup>-2</sup>

**Table 2: Activity Against *Staphylococcus aureus***  
(Geometric Mean of 3 Replicates as Colony Forming Units cm<sup>-2</sup>)

Sample	Contact Time	
	0 hours	24 hours
Polypropylene	1.7 x 10 <sup>4</sup>	2.1 x 10 <sup>3</sup>
Shower Head	1.7 x 10 <sup>4</sup>	< 1.0

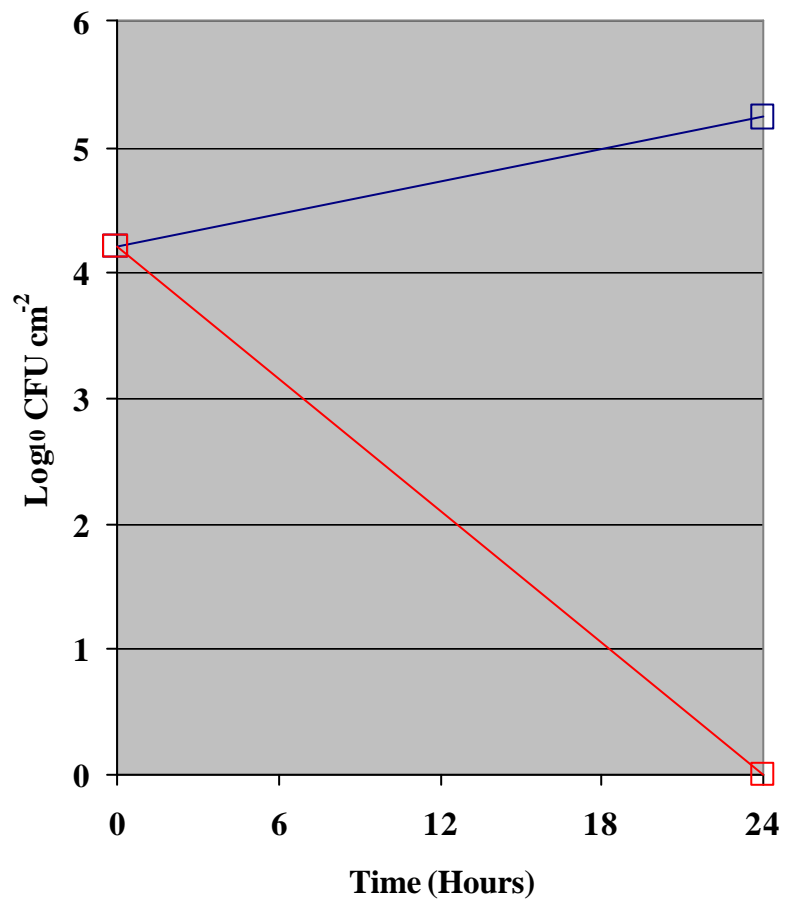
‡ The theoretical limit of detection is 1 CFU cm<sup>-2</sup>

It can be seen from the results above that the population of *E coli* exposed to unfortified polypropylene increased in size by 1 order of magnitude during the 24 hour contact interval. In contrast, the populations that were held in contact with the outer surface of the shower heads were reduced by  $\geq 4.2$  orders of magnitude, to below the limit of detection.

The population of *Staphylococcus aureus* exposed to the unfortified control sample declined by 1 order of magnitude during the 24 hour contact period. As with *E coli*, the populations that were held in contact with the outer surface of the shower heads were reduced by  $\geq 4.2$  orders of magnitude, to below the limit of detection.

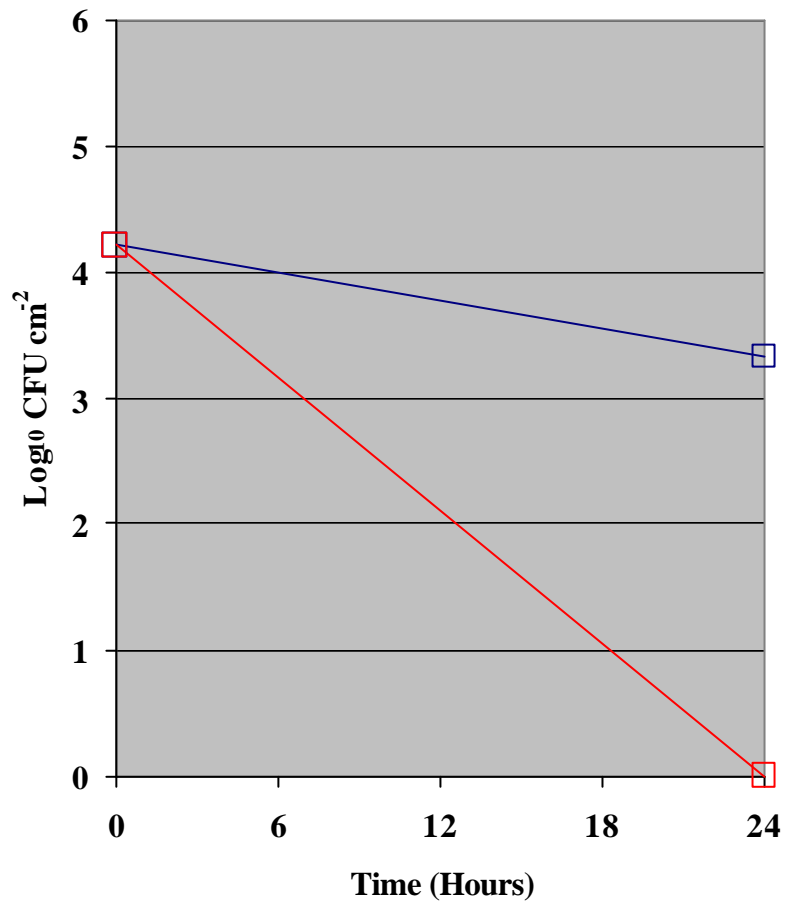
Figure 2: Results as Log<sub>10</sub> CFU cm<sup>-2</sup>

*Escherichia coli*



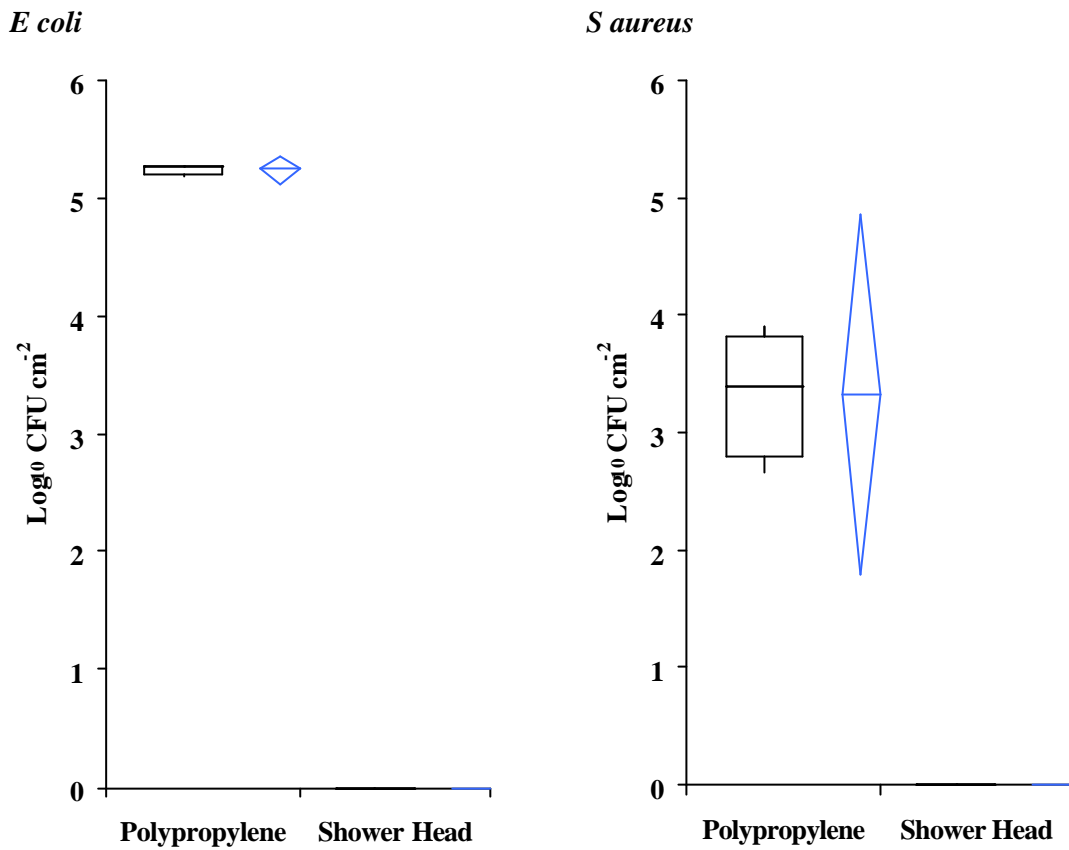
—□— Polypropylene —□— Shower Head

*Staphylococcus aureus*



—□— Polypropylene —□— Shower Head

**Figure 3: Confidence Intervals of the Data**



## 5 Raw Data

The raw data for this study will be held in file IMSL 2009/11/010 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: 2007, Plastics - Measurement of antibacterial activity on plastics surfaces.

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