IMSL

INDUSTRIAL MICROBIOLOGICAL SERVICES LTD

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: **7th February 2010**

Contents

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

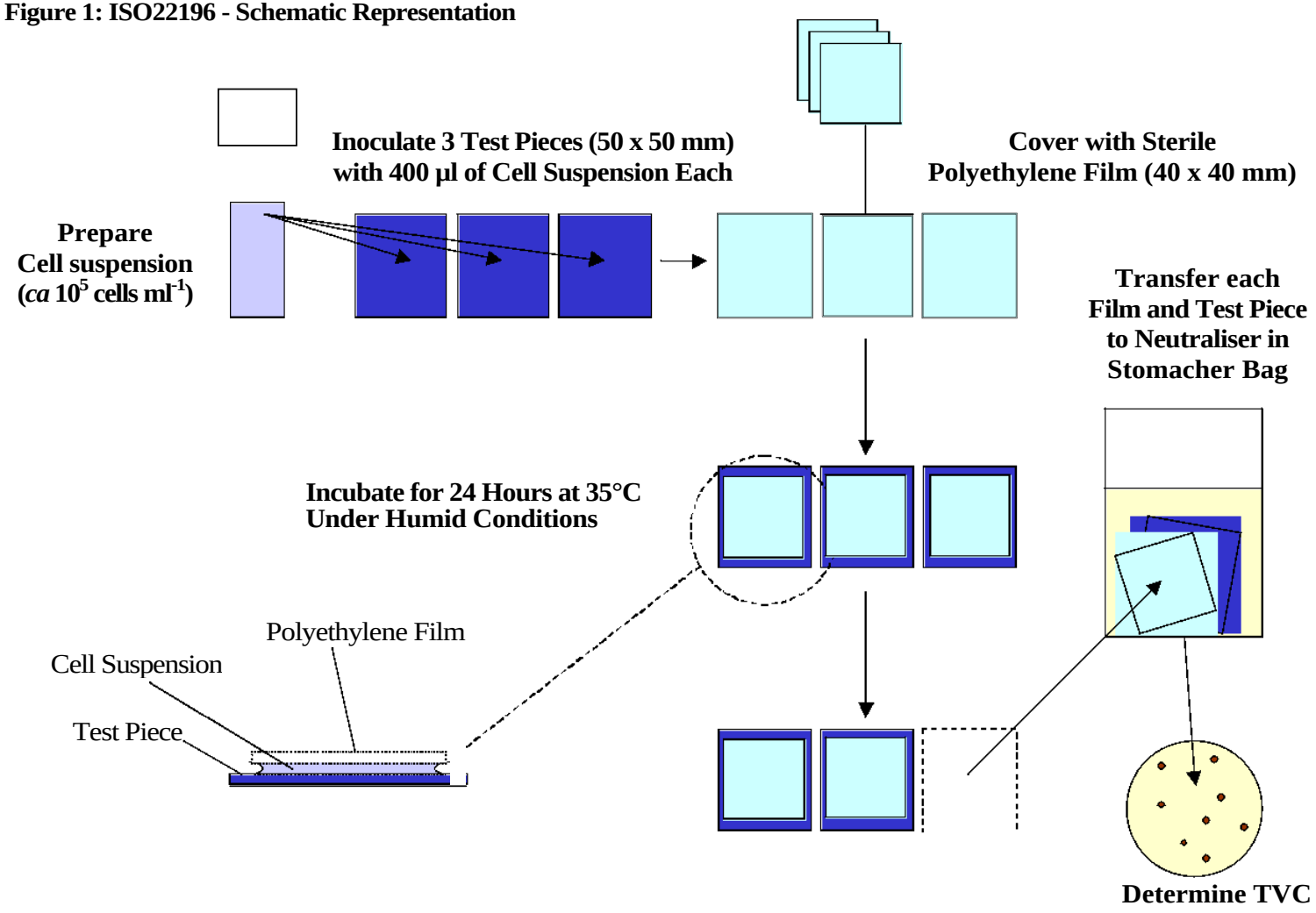
Antibacterial activity was determined using the method described in ISO22196 : 2007 (Ref 1).

3.1 Determination of Antibacterial Activity

An aliquot (225µl) of a log phase cell suspension of either *E coli* (4.7×10^5 cells ml^{-1}; ATCC 8739) or *Staph aureus* (5.0×10^5 cells ml^{-1}; ATCC 6538p) prepared using the method described in ISO22 196 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 3 5°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^{-2} and then transformed to provide a dataset that conformed to a gausian 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^{-2})

Sample	Contact Time 0 hours	Contact Time 24 hours
Polypropylene	1.6×10^4	1.8×10^5
Shower Head	1.6×10^4	< 1.0

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

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

Sample	Contact Time 0 hours	Contact Time 24 hours
Polypropylene	1.7×10^4	2.1×10^3
Shower Head	1.7×10^4	< 1.0

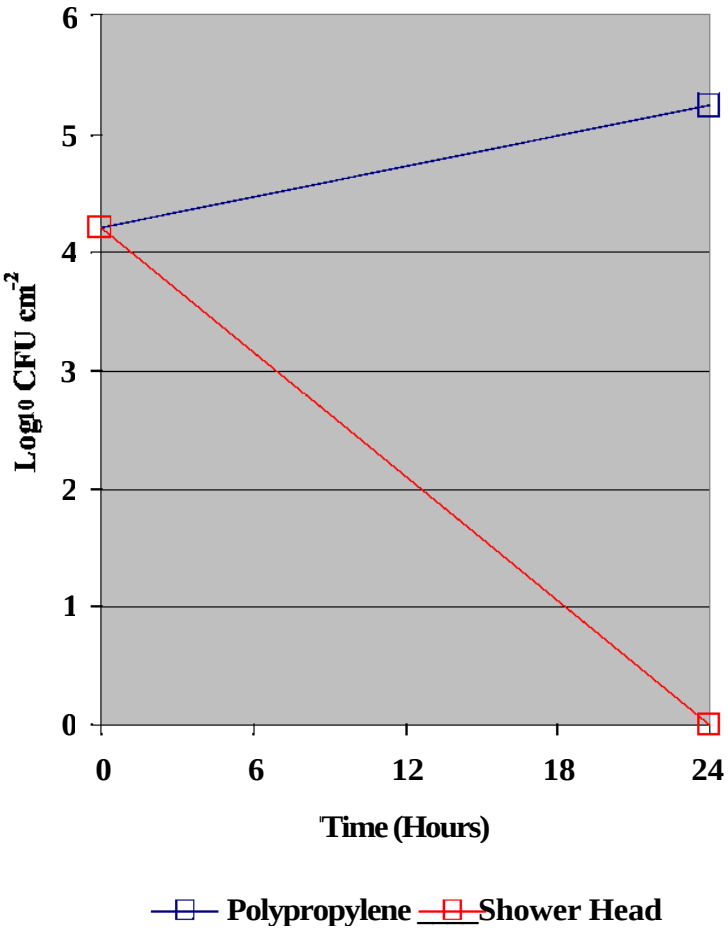
‡ The theoretical limit of detection is 1 CFU cm^{-2}

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 > 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 > 4.2 orders of magnitude, to below the limit of detection.

Figure 2: Results as $_{Log10}$ CFU cm^{-2}

Escherichia coli



Staphylococcus aureus

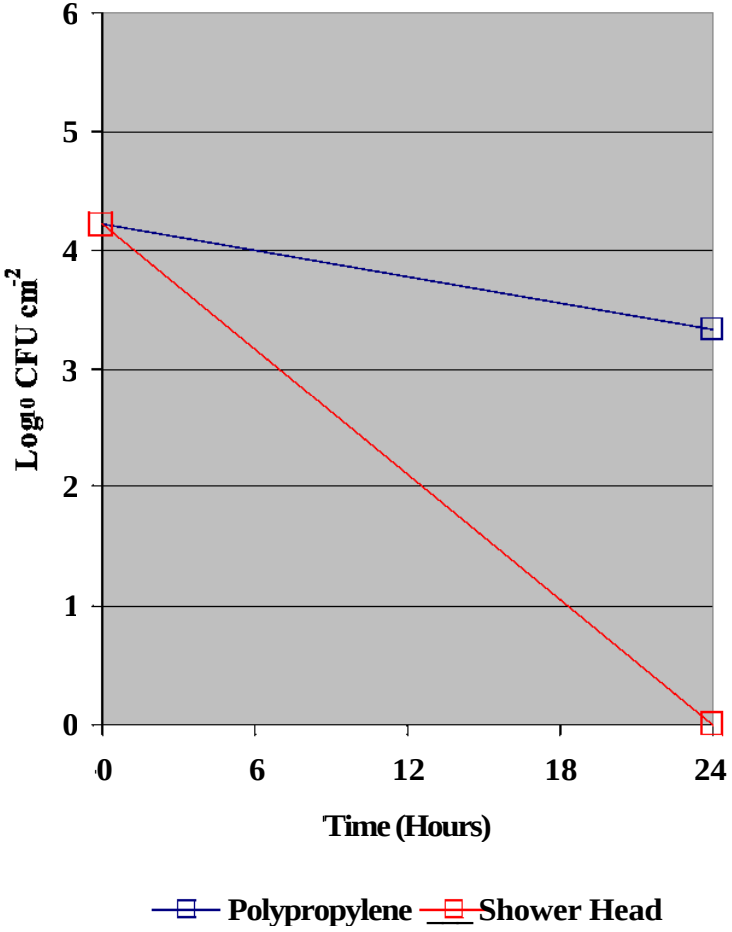
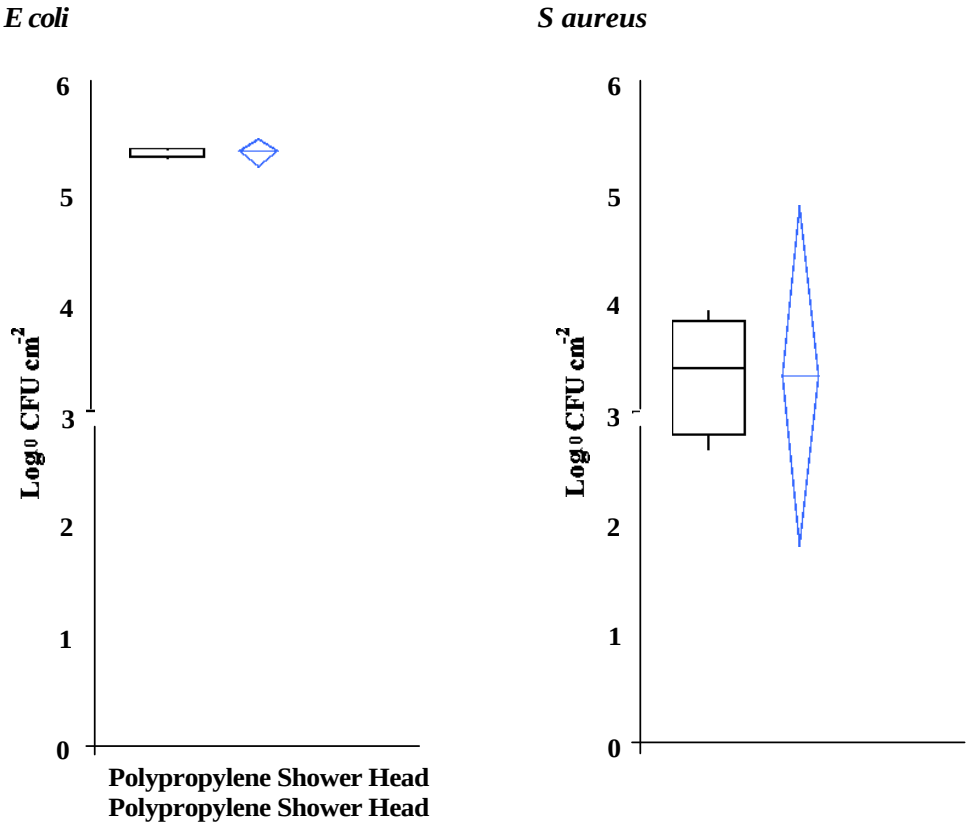


Figure 3: Confidence Intervals of the Data



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.

7 Exclusion of Liability

The contents of this report are subject to the standard terms and conditions of IMSL as displayed on the reverse of the invoice. Specific attention is drawn to Section 10 restated below.

(a) IMSL warrants that the results as stated in this Report are accurate in so far as they relate to the Samples as received in the laboratory of IMSL. Except in respect of death or personal injury caused by IMSL's negligence IMSL accepts no other liability or responsibility to any party whatsoever (whether caused by the negligence of IMSL, its employees, or agents or otherwise) arising out of or in connection with the provision of this Report. In particular, but without prejudice in the generality of the foregoing IMSL shall have no liability or responsibility whatsoever in respect of or in any way by reference to:-

(i) the taking of the Samples (unless this is done by an agent of IMSL), the accuracy of the Samples or their suitability for the purpose(s) for which they were taken or applied, the designation, handling, storage or transport of the Samples prior to their delivery to the laboratory of IMSL or their condition upon such delivery

(ii) the interpretation of the Report and / or the application of the results as stated and / or the accuracy of any advices based thereon

(iii) any (or any alleged) lack of competence, negligence, failure or breach of duty on the part of any person engaged in or responsible for any of the activities or functions referred to above whether or not such agent is described as an agent of IMSL or otherwise. All such persons shall be deemed to be agents of the Customer and not to be agents or representatives in any capacity of IMSL

(iv) incorrect information or data supplied by the Customer relating to the Samples

(v) loss of or damage to the Samples when in the possession of IMSL

(vi) delay in provision of the Service or mis-delivery or non-delivery of any Report or Sample.

(b) In the event of any claim arising against IMSL, IMSL expressly excludes liability for any consequential loss or damage or any loss of value, profit, business, revenue, goodwill, yields, production or anticipated saving which may arise in respect of or in any way by reference to any Report, analysis, advice or information given verbally by any person or contained in any Report, leaflet, book, pamphlet, brochure or any other document, whether prepared, published or issued by IMSL or otherwise.