

ANTIMICROBIOLOGICAL TESTS CARRIED OUT IN CONFORMITY WITH ISO 22196 ON iPROTECT BALLPOINT PENS MADE OF ABS FUNCTIONALIZED WITH ZINC IONS, ACCORDING TO THE PROCESS PATENTED MI2013A000469

Evaluation of the surface antimicrobiological effectiveness

Aim: Evaluation of the possible decrease in bacterial load obtained after the contact for a known period of time between parts of the iProtect pens made of antibacterial ABS treated with Zinc ions (according to the patented process MI2013A000469) and two reference microbiological strains.

The product under investigation:

- iProtect pens made of plastic (**S14-068**) treated with Zinc ions to make it antibacterial

Microbic strains utilized:

- *Escherichia coli* (Gram negative bacterium; Gram -) ATCC 25922
- *Staphylococcus Aureus* (Gram positive bacterium; Gram +) ATCC 6538P

Method

The samples have been tested according to the process described by **ISO 22196:2011**, which is an International Standard Method to evaluate the antibacterial activity on plastic not porous surfaces.

EXPERIMENTAL PROCEDURE:

The starting bacterial suspensions were diluted to obtain a known bacterial concentration expressed by units forming a colony –ufc/ml. The polymers were treated with the reference microbial strains, then covered with a PE sterile film and incubated at 37 ± 1 °C for 24 hours. At this stage, the samples were washed with a neutralizing solution where the residual microbial load was detected.

The test was repeated three times and the results are reported in Table 1.

Table 1: Antibacterial activity of sample S14-068 against *Escherichia Coli* ATCC 8739 (Gram -) and *Staphylococcus Aureus* ATCC 6538 (Gram +).

The results reported here represent the average of the three tests per type of product.

MICROBIC STRAINS	Initial inoculation (ufc/ml)	37°C per 24 h	Checkout inoculation	ABS 0-4 (cod. S14 068)	Decrease %
<i>Escherichia coli</i>	3.0×10^5		1.4×10^8	5.5×10^5	99.6 %
<i>Staphylococcus Aureus</i>	5.5×10^4		3.7×10^8	7.3×10^6	98,0 %

CONCLUSION:

In consideration of the results obtained from the *in vitro* tests, it can be stated that the residual bacterial load found on the samples of the treated pens after the contacting period is quantitatively lower respect to the one compared to the control pattern. The inhibition percentage ranges from 98.0 to 99.6% both for *Escherichia coli* (Gram -) common biologic indicator in environmental pollution, and *Staphylococcus aureus* (Gram +), which is one of the most common pathogenic bacterium responsible for skin infections.

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