BACTERIOSTATIC TESTS CARRIED OUT IN CONFORMITY WITH ISO 22196:2011 ON STILOLINEA iPROTECT® BALLPOINT PEN MADE OF ABS FUNCTIONALIZED WITH CLENYA BASED ON ZINC IONS.

Evaluation of the surface bacteriostatic effectiveness

Aim : Evaluation of the possible decrease in bacterial presence obtained after the contact for a known period of time between parts of the iPROTECT® pen made of bacteriostatic ABS treated with Clenya and 12 references microbiological strains.

The product under investigation:

iPROTECT® pen made of ABS functionalized with Clenya to make it bacteriostatic.

Bacterial strains utilized :

Escherichia coli ATCC 25922

Staphylococcus aureus ATCC 6538P

Meticillin-resistant Staphylococcus aureus (MRSA) ATCC 33591

Acinetobacter Baumannii ATCC 19606

Pseudomonas aeruginosa

Enterobacter cloacae

Candida albicans

Clostridium diff.

Streptococco pyogene

Klebsiella pneumoniae

Proteus vulgaris

Salmonella

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 microbical strains, then covered with a PE sterile film and incubated at 37+/- °C for 24 hours. At this stage, the samples were washed with a neutralizing solution where the residual microbical load was detected.

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

MICROBIC FAMILIES	Initial Inoculum	Inoculum control	ABS PEN	Log reduction	Reduction%
Escherichia coli	$3,0 \times 10^6$	$3,5 \times 10^7$	$3,95 \times 10^5$	**1,95**	**99,8**
Staphylococcus aureus	$5,2 \times 10^6$	$2,83 \times 10^7$	$1,71 \times 10^5$	**2,22**	**99,7**
MRSA	$2,4 \times 10^5$	$2,16 \times 10^7$	$3,95 \times 10^4$	**2,73**	**97,2**
Acinetobacter baum.	$2,5 \times 10^6$	$4,00 \times 10^7$	$3,15 \times 10^6$	**1,10**	**98,1**
Ps.aeruginosa	$1,5 \times 10^6$	$1,59 \times 10^7$	$1,75 \times 10^4$	**2,95**	**99,2**
Ent.cloacae	$4,72 \times 10^6$	$2,08x\ 10^7$	$1,75 \times 10^5$	**2,07**	**99,5**
C.albicans	1×10^7	$1,53 \times 10^7$	$8,70 \times 10^5$	**1,24**	**98,5**
Clostriudim diff.	1×10^6	$1,2 \times 10^6$	$1,4 \times 10^4$	**1,93**	**98,1**
Streptococco pyogene	$2,5 \times 10^6$	$4,01 \times 10^7$	$3,15 \times 10^6$	**1,10**	**98,1**
Klebsiella pn.	1×10^7	$1,53 \times 10^7$	$8,7 \times 10^5$	**1,24**	**98,8**
Proteus Vulgaris	$3,0 \times 10^6$	$3,5 \times 10^7$	$3,94 \times 10^5$	**1,95**	**98,9**
Salmonella	$4,71 \times 10^6$	$2,08 \times 10^7$	$1,75 \times 10^5$	**2,07**	**99,2**

Conclusion:

The study of the modification of ABS chemical composition with addition of Clenya based on zinc ions let us define the correct formulation of the bacteriostatic plastic without using toxic substances and without modifying its functional and esthetical properties.

The Stilolinea iPROTECT® pen made by this new material has been tested against the most important bacterial strains (Escherichia coli, Staphylococcus aureus, Meticillin-resistant, Acinetobacter Baumannii,Pseudomonas aeruginosa, Enterobacter cloacae, Clostridium diff., Candida albicans, Streptococco pyogene, Klebsiella pneumoniae, Proteus vulgaris, Salmonella).

The results clearly indicate how the Clenya addition guarantees a substantial – almost total – decrease of the bacterial charge with percentages in the range of 97% and 99%.

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