

Influence of air ionization on the reduction of bacteria in a chiller spread onto hard surfaces commonly used in the food industry

Tests conducted by:
Sorensen Laboratories LTD
Auckland (New Zealand)
06.10.1993

test room:	chiller
dimensions:	18 m ³
temperature:	4 ± 1 °C
humidity:	85 – 90 %
appliance:	aerotec 90
ionization tubes:	3 pcs.
type:	IRF
dimensions:	length: 520 mm; diameter: 38 mm
cultivation parameter:	
period of germination:	24 h
temperature:	35 °C
measurement counts:	5 swabs
measurement area:	25 cm ² / each swab 5 cm ²
measuring protocol:	
three measurements at: 0, 16, 40, 80 h ionization turned off	
three measurements at: 0, 16, 40, 80 h ionization turned on	

inoculation method:

inoculation location: cultures were swabbed onto the test surfaces, about 1ml per 84 cm²

test surfaces:

Stainless steel plate

High density polyethylene cutting board (used)

PVC belt

Cross-cut beef

inoculation cultures:

Salmonella agona

Shigella flexneri

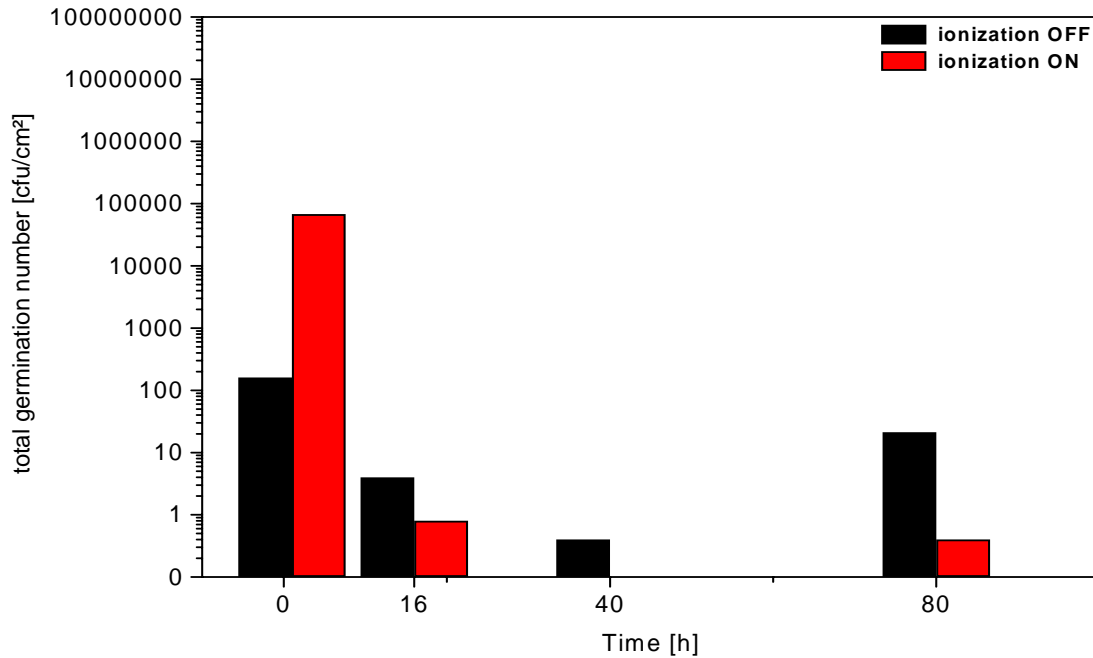
Listeria monocytogenes

Escherichia coli

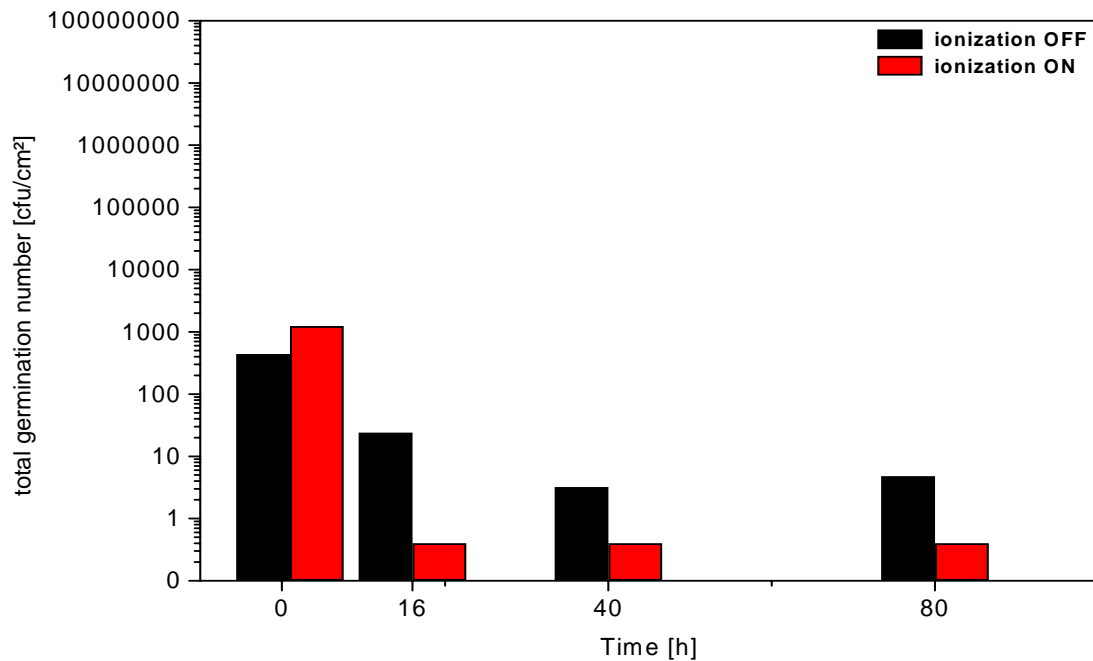
Pseudomonas aeruginosa

All organisms were inoculated as a single culture.

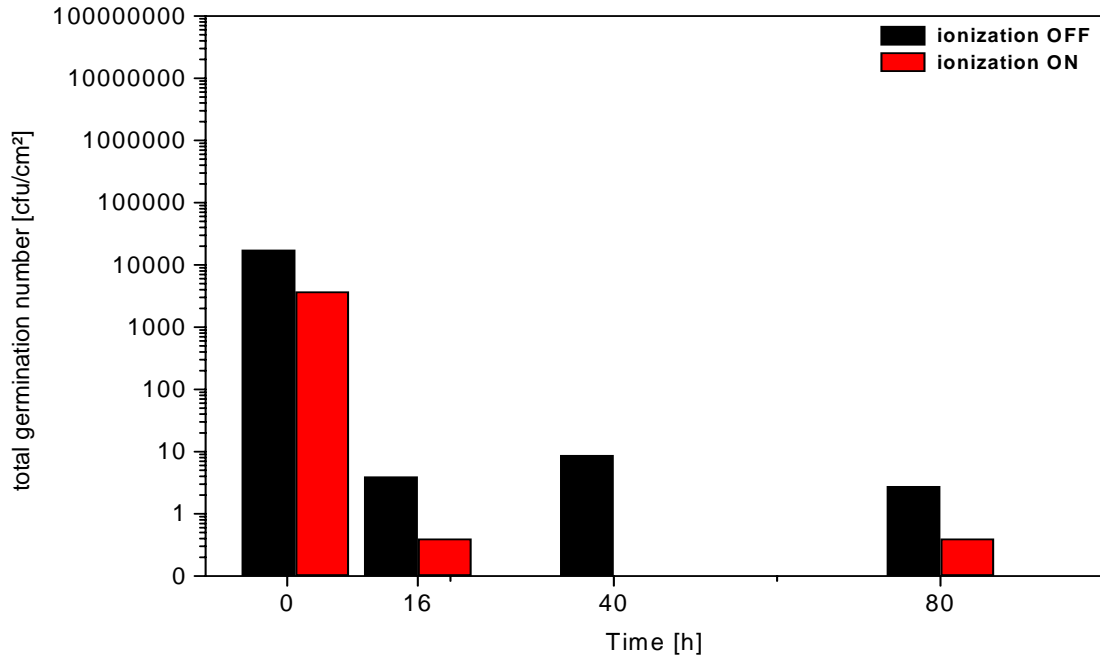
Influence of air ionization on the reduction of SALMONELLA AGONA



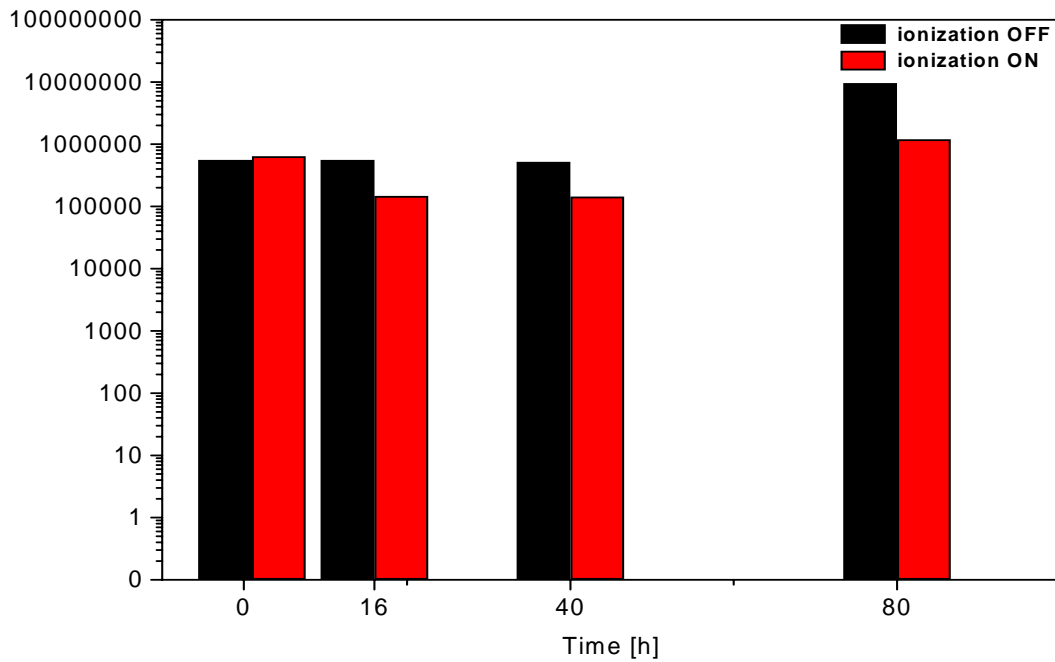
SALMONELLA AGONA inoculated on a STAINLESS STEEL PLATE



SALMONELLA AGONA inoculated on a HIGH DENSITY POLYETHYLENE CUTTING BOARD (USED)

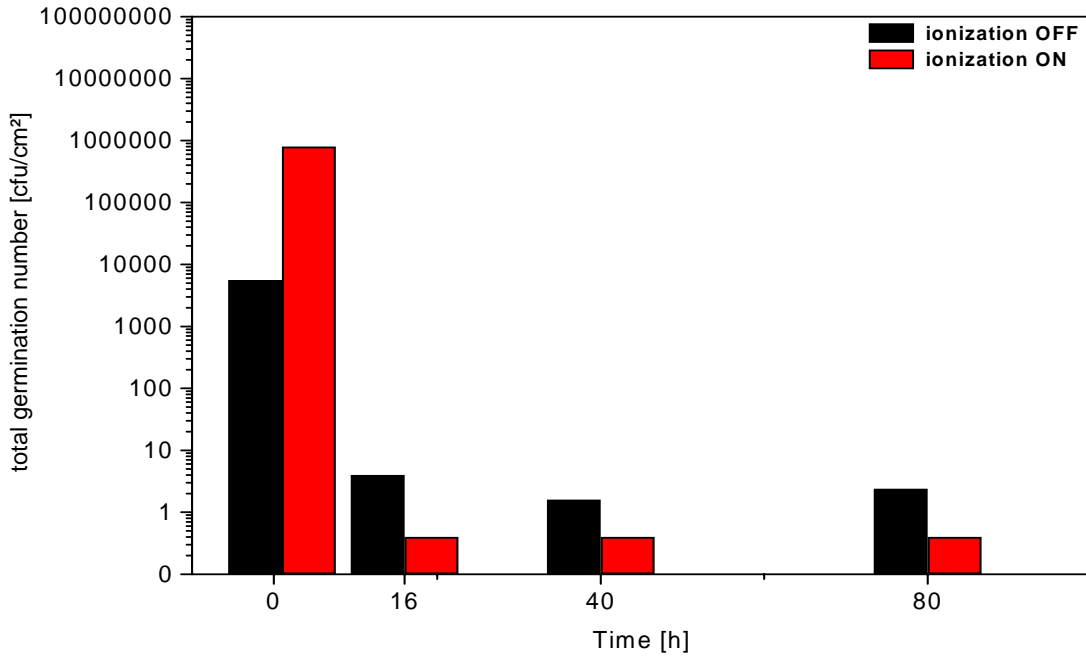


SALMONELLA AGONA inoculated on PVC BELT

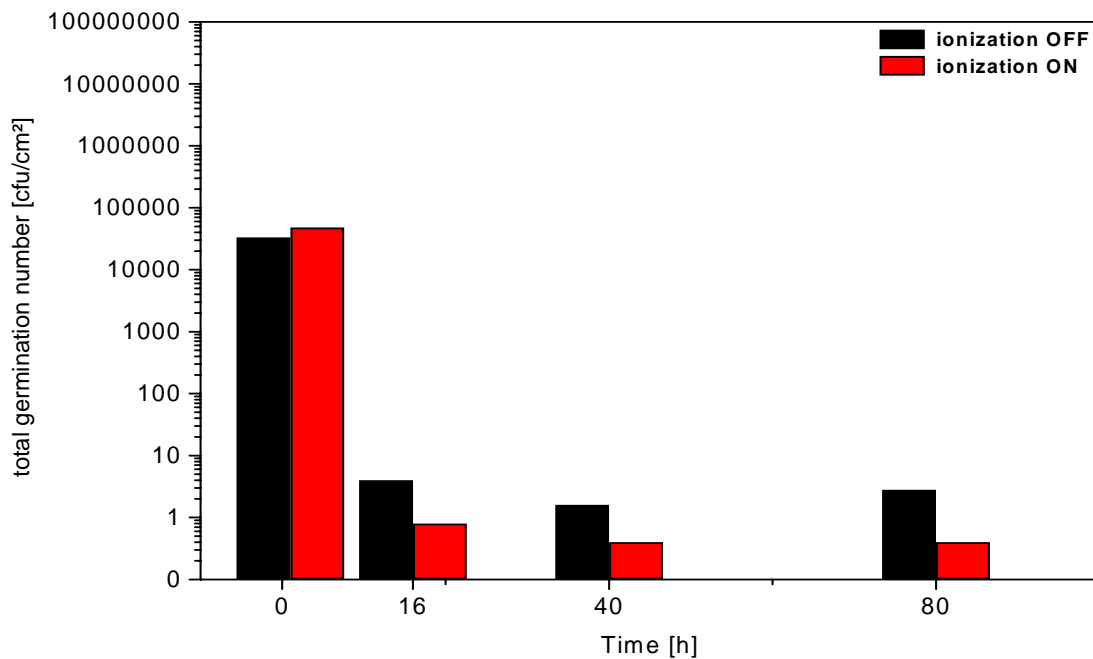


SALMONELLA AGONA inoculated on a CROSS-CUT BEEF

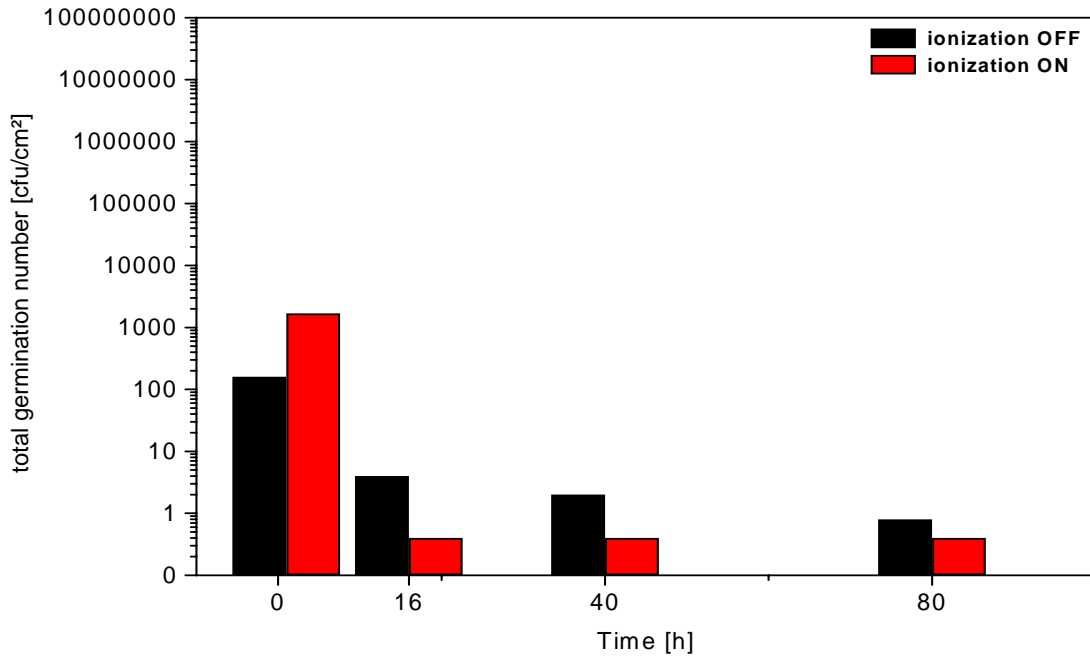
Influence of air ionization on the reduction of SHIGELLA FLEXNERI



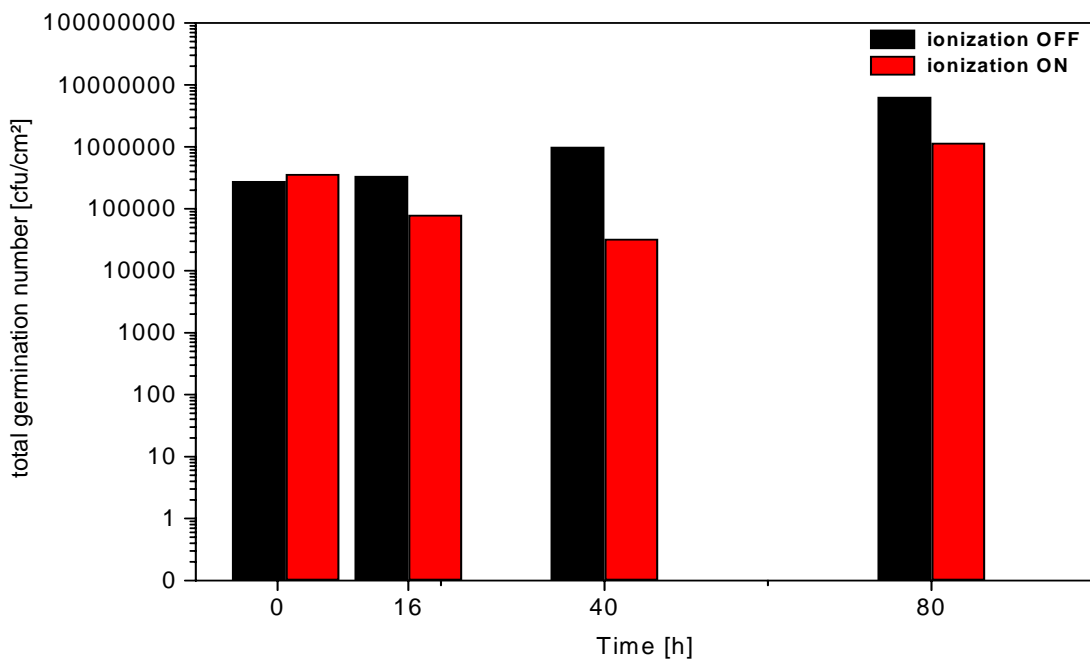
SHIGELLA FLEXNERI inoculated on a STAINLESS STEEL PLATE



SHIGELLA FLEXNERI inoculated on a HIGH DENSITY POLYETHYLENE CUTTING BOARD (USED)

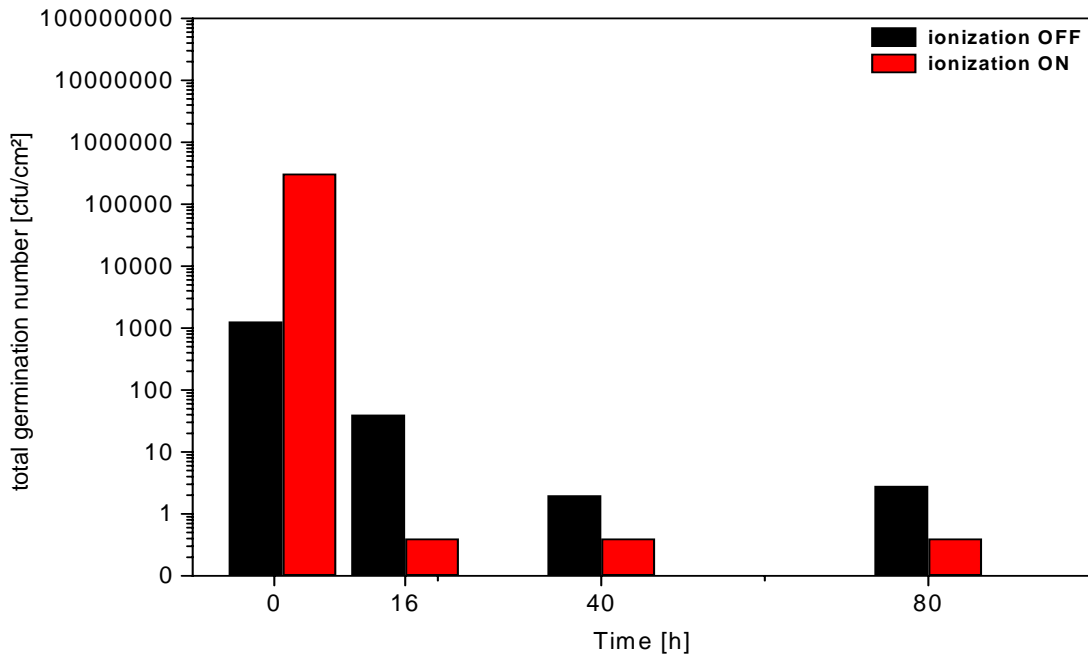


SHIGELLA FLEXNERI inoculated on PVC BELT

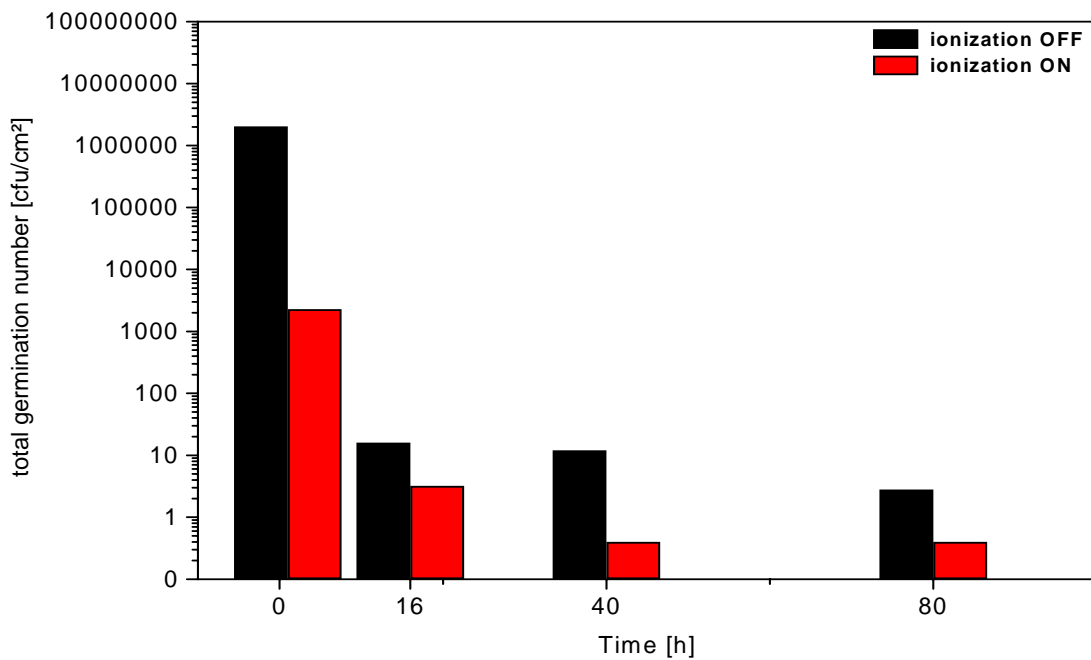


SHIGELLA FLEXNERI inoculated on a CROSS-CUT BEEF

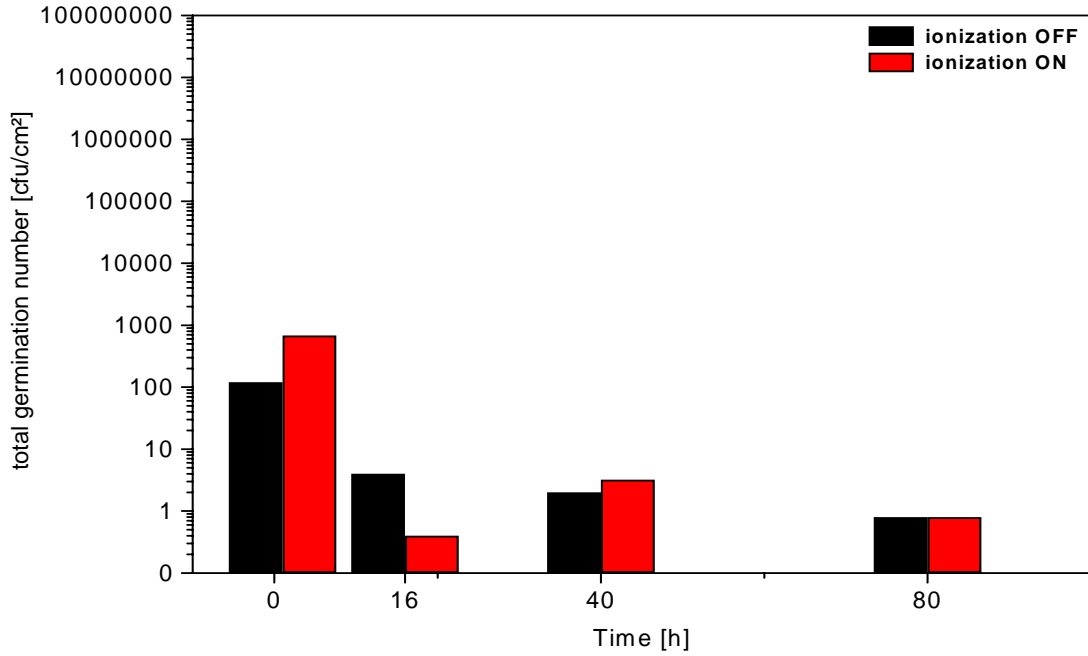
Influence of air ionization on the reduction of LISTERIA MONOCYTOGENES



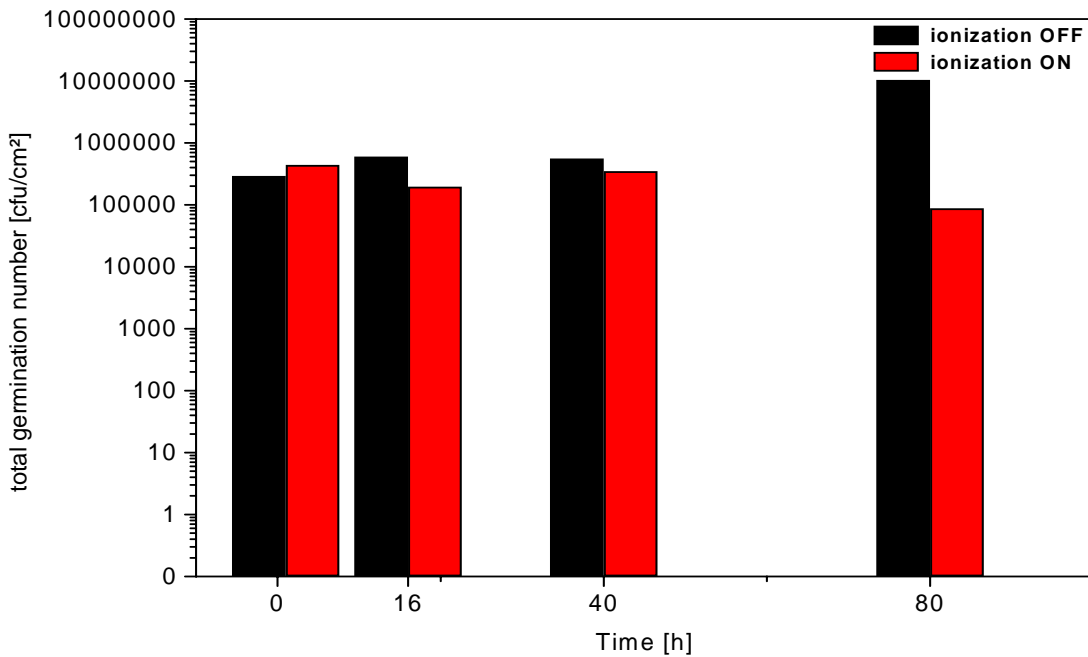
LISTERIA MONOCYTOGENES inoculated on a STAINLESS STEEL PLATE



LISTERIA MONOCYTOGENES inoculated on a HIGH DENSITY POLYETHYLENE CUTTING BOARD (USED)

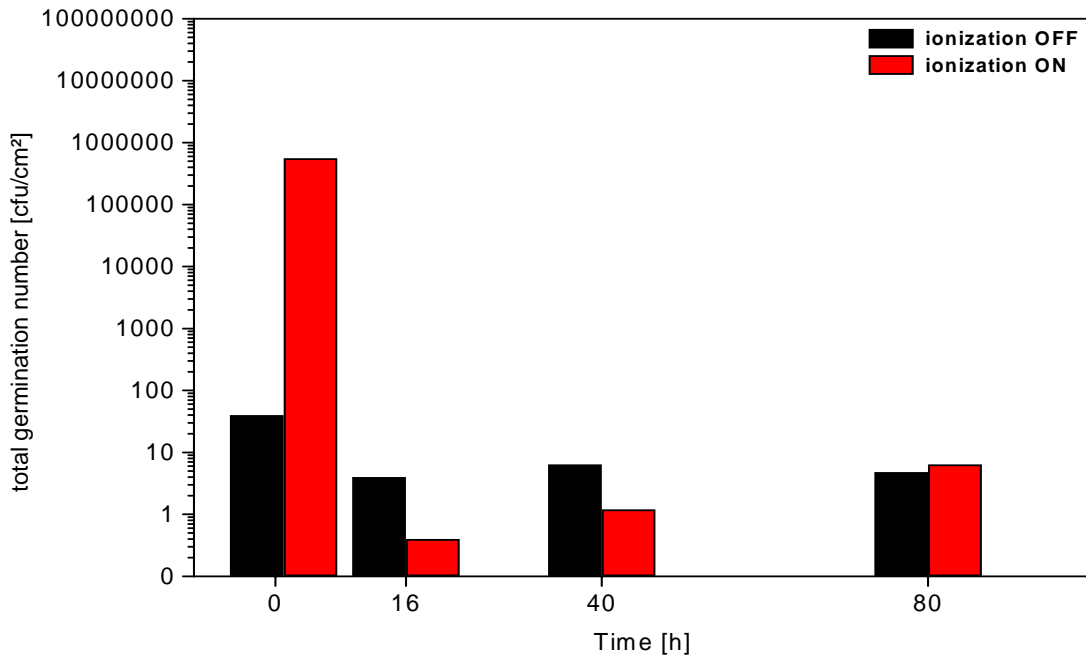


LISTERIA MONOCYTOGENES inoculated on PVC BELT

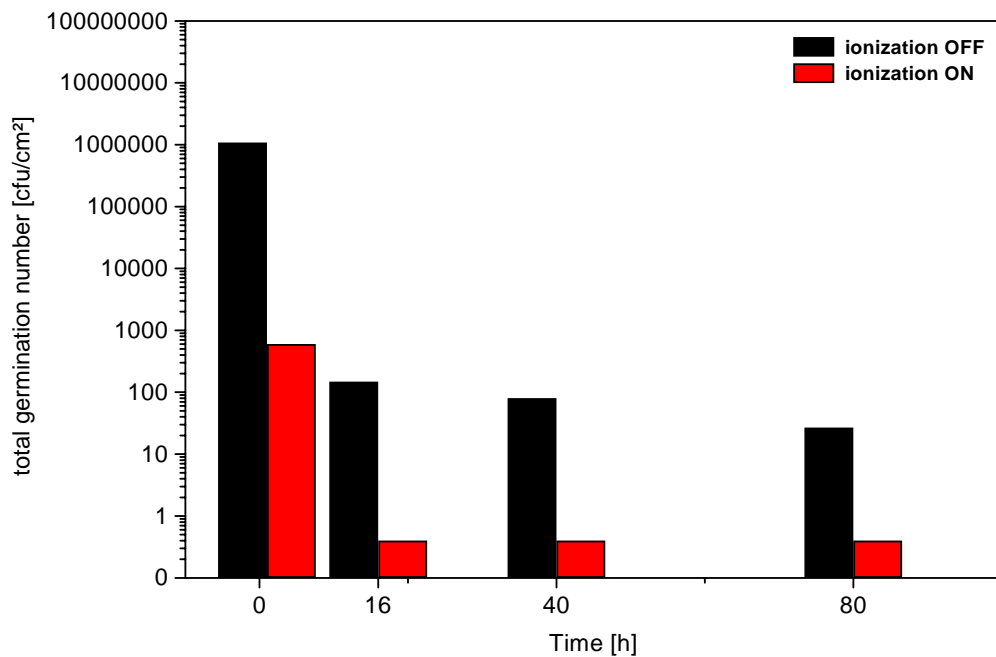


LISTERIA MONOCYTOGENES inoculated on a CROSS-CUT BEEF

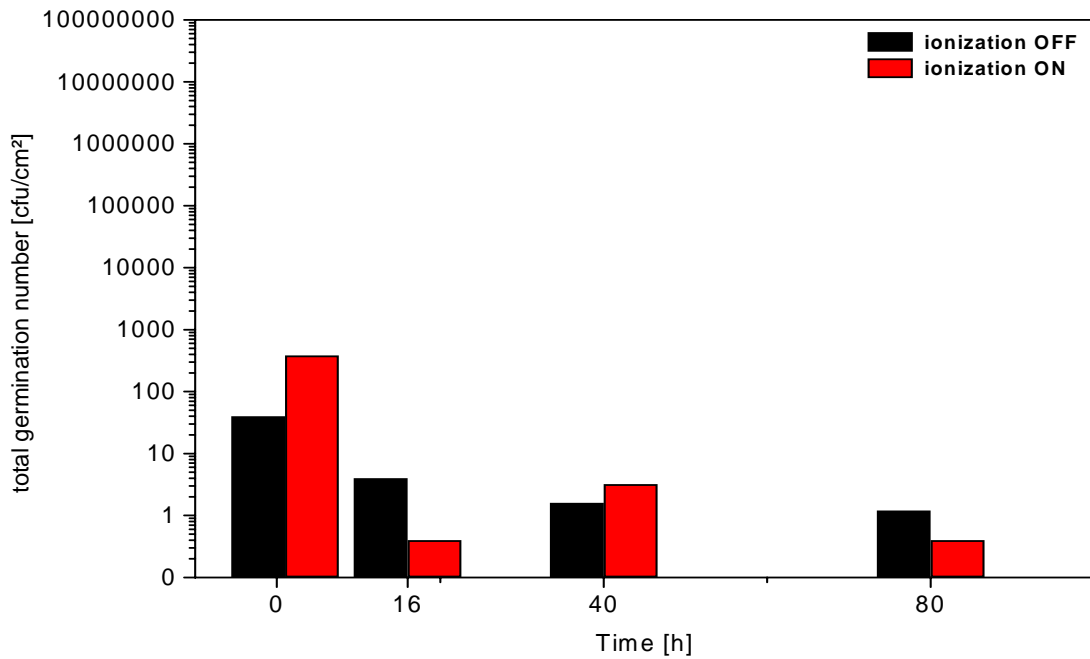
Influence of air ionization on the reduction of ESCHERICHIA COLI



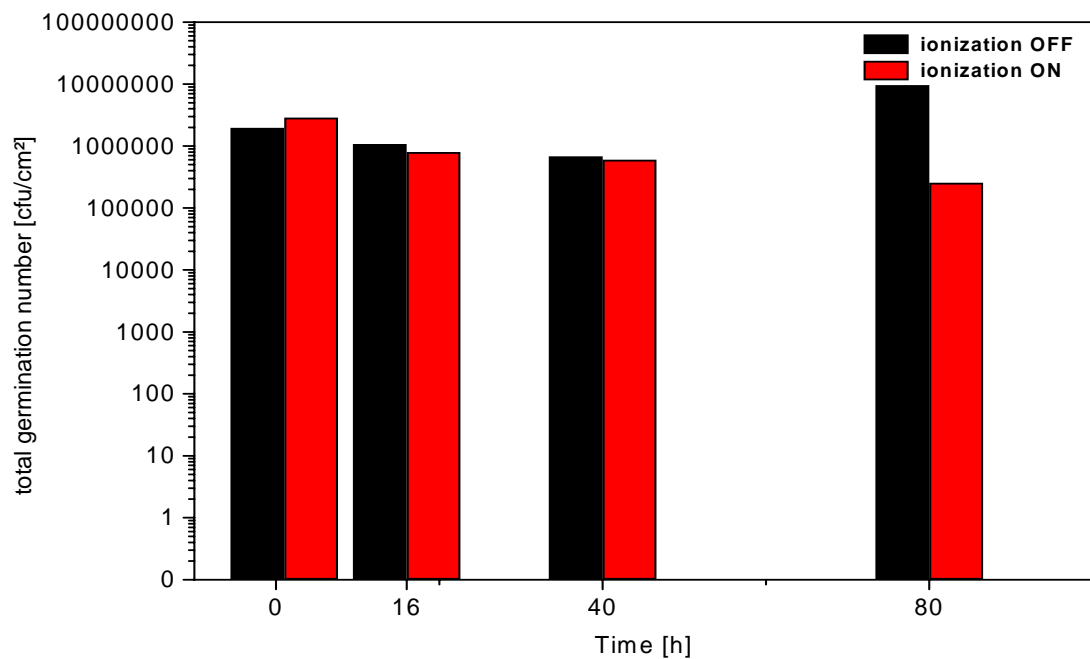
ESCHERICHIA COLI inoculated on a STAINLESS STEEL PLATE



ESCHERICHIA COLI inoculated on a HIGH DENSITY POLYETHYLENE CUTTING BOARD (USED)

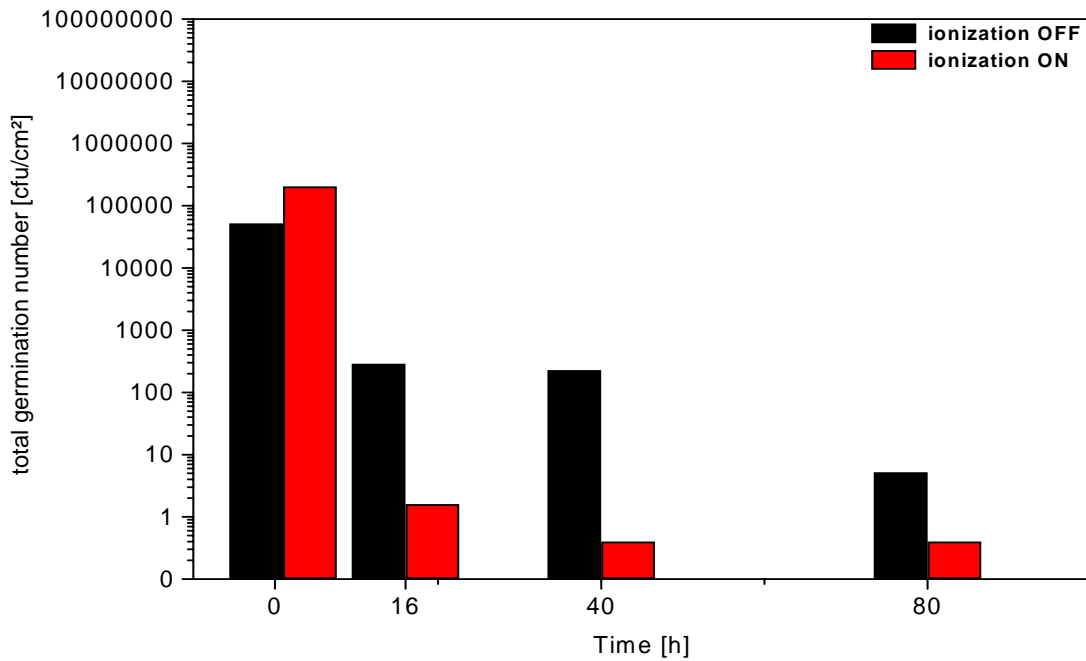


ESCHERICHIA COLI inoculated on PVC BELT

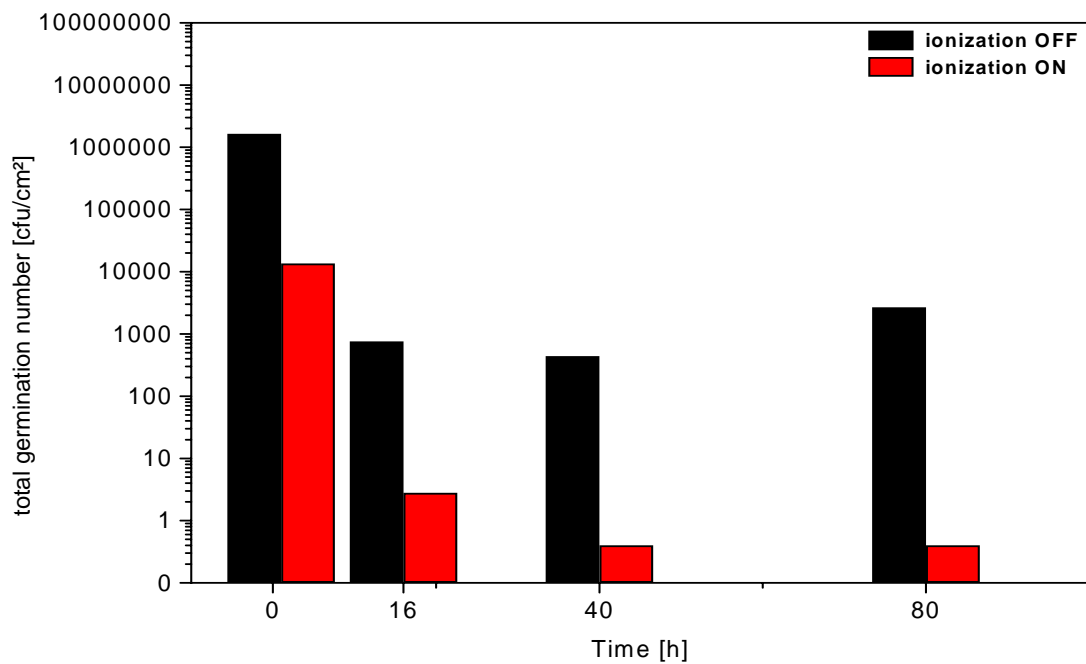


ESCHERICHIA COLI inoculated on a CROSS-CUT BEEF

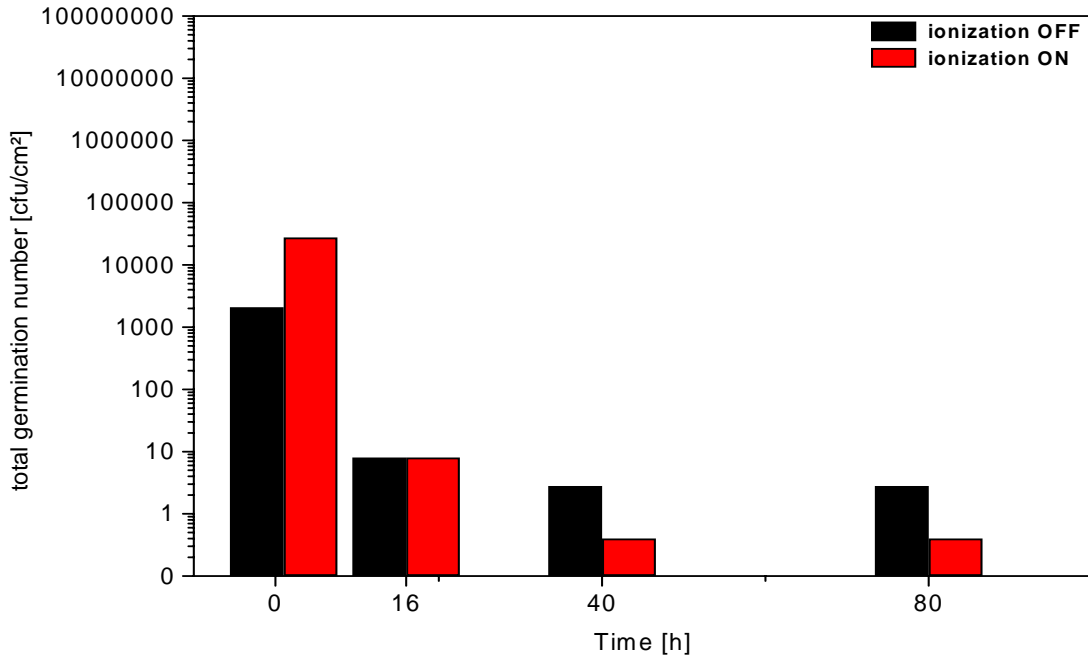
Influence of air ionization on the reduction of PSEUDOMONAS AERUGINOSA



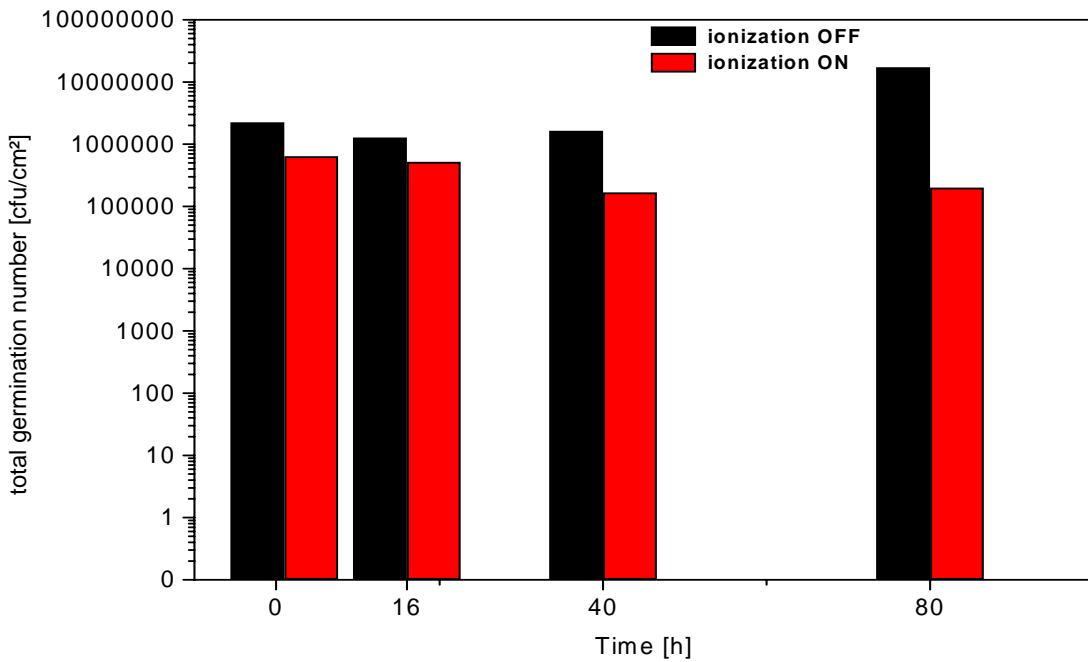
PSEUDOMONAS AERUGINOSA inoculated on a STAINLESS STEEL PLATE



PSEUDOMONAS AERUGINOSA inoculated on a HIGH DENSITY POLYETHYLENE CUTTING BOARD (USED)



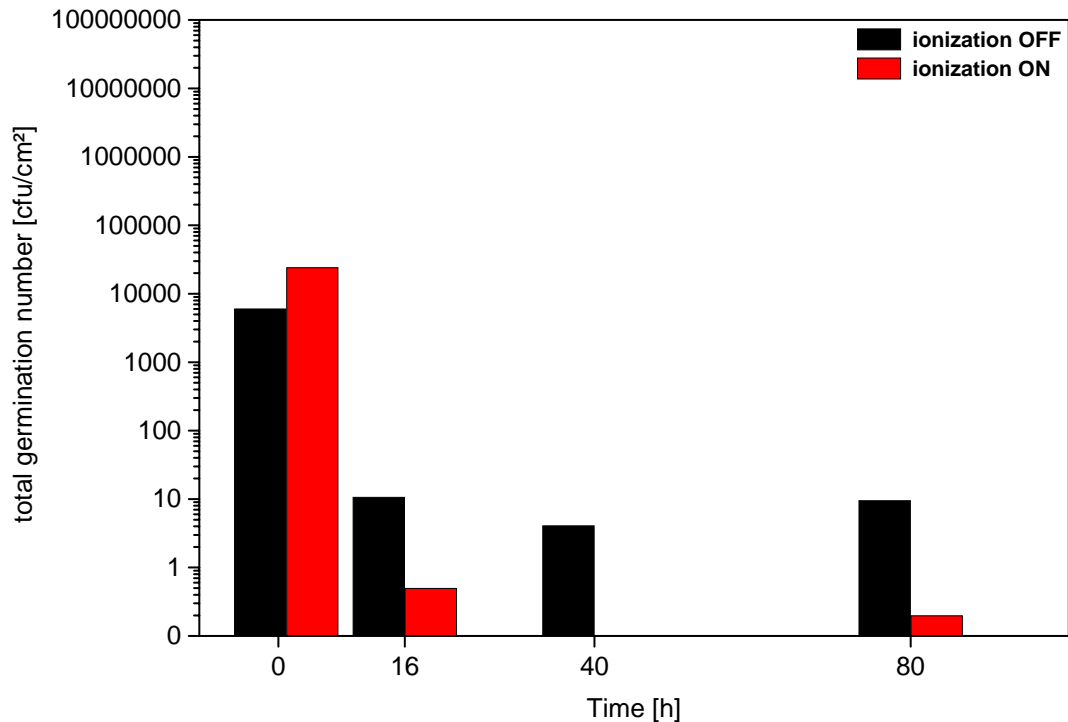
PSEUDOMONAS AERUGINOSA inoculated on PVC BELT



PSEUDOMONAS AERUGINOSA inoculated on a CROSS-CUT BEEF

SUMMARY

SALMONELLA AGONA:

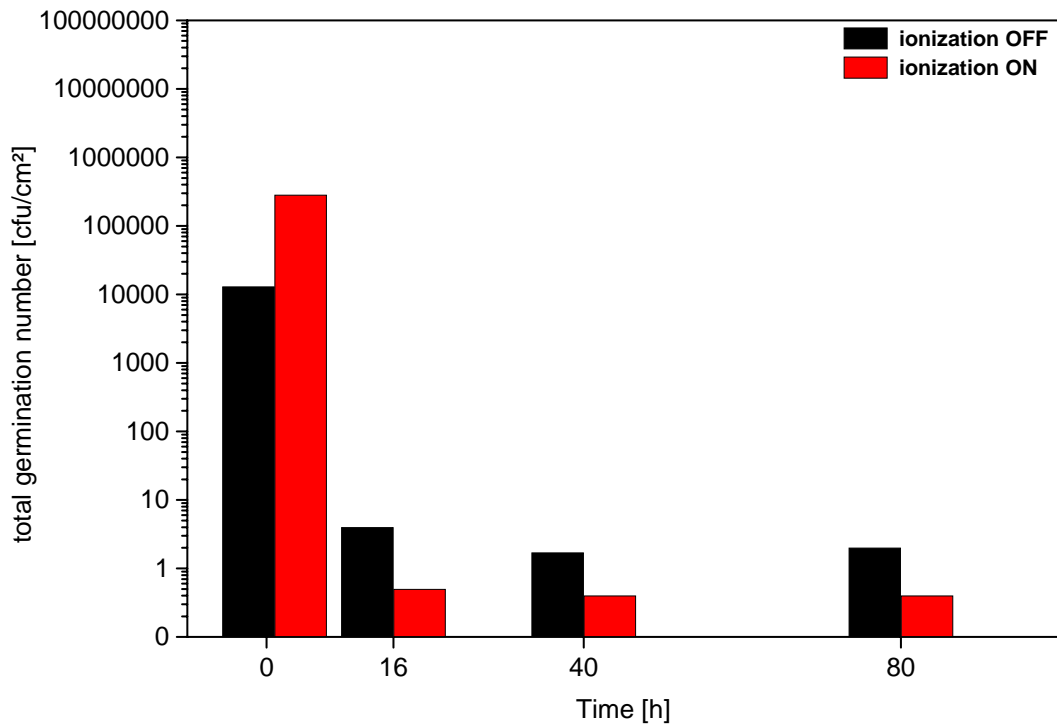


Average germination numbers
(Stainless Steel, High Density Polyethylene Chopping Board (Used), PVC Belt)
of SALMONELLA AGONA

Salmonella Agona are reduced very rapidly on hard surfaces held under the test conditions selected (4 °C, 85 % r.H.). The results do show that small numbers of Salmonella Agona can survive under this conditions.

When the **aerotec 90** was turned on, such remnants were eliminated.

SHIGELLA FLEXNERI:

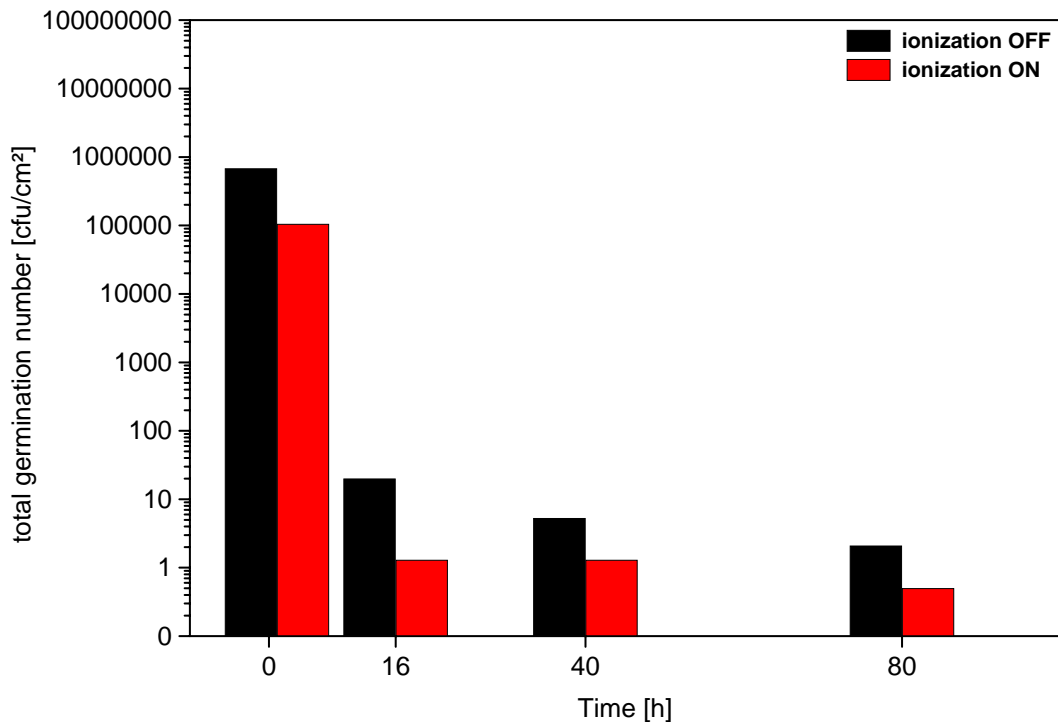


Average germination numbers
(Stainless Steel, High Density Polyethylene Chopping Board (Used), PVC Belt)
of SHIGELLA FLEXNERI

It was found, that both, the treated and the untreated samples showed a rapid decies in the number of viable organisms.

The Shigella Flexneri died off too quickly under the test conditions selected, to show any significant effect of the **aerotec 90**.

LISTERIA MONOCYTOGENES:



Average germination numbers
(Stainless Steel, High Density Polyethylene Chopping Board (Used), PVC Belt)
of LISTERIA MONOCYTOGENES

Listeria Monocytogenes has the property to be able to survive and grow in chillers operating at 4 °C.

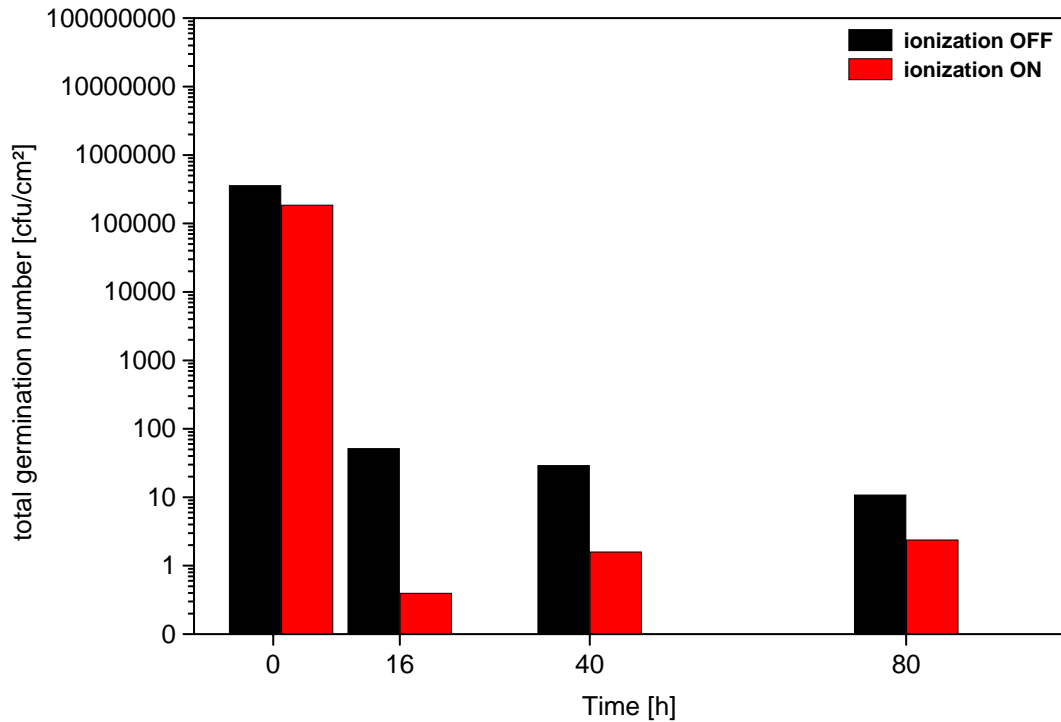
The results show a higher death rate in the treated samples, than in the untreated.

Whilst this relates to some extent to pre-inoculated organisms, confirmatory tests

showed there to be no survivors of Listeria Monocytogenes in the samples treated with

the **aerotec 90**.

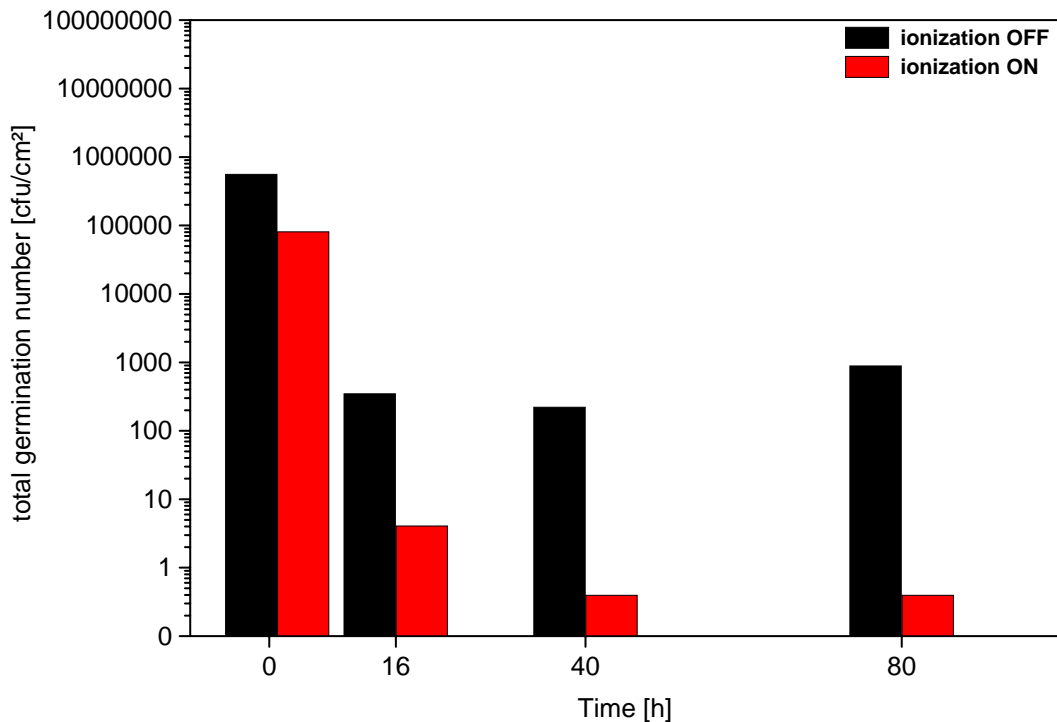
ESCHERICHIA COLI:



Average germination numbers
(Stainless Steel, High Density Polyethylene Chopping Board (Used), PVC Belt)
of ESCHERICHIA COLI

Like Shigella Flexneri, E. Coli are found to have a high death rate when applied to hard surfaces held in the test conditions outlined. For this reason it is difficult to gauge the effect of the **aerotec 90**.

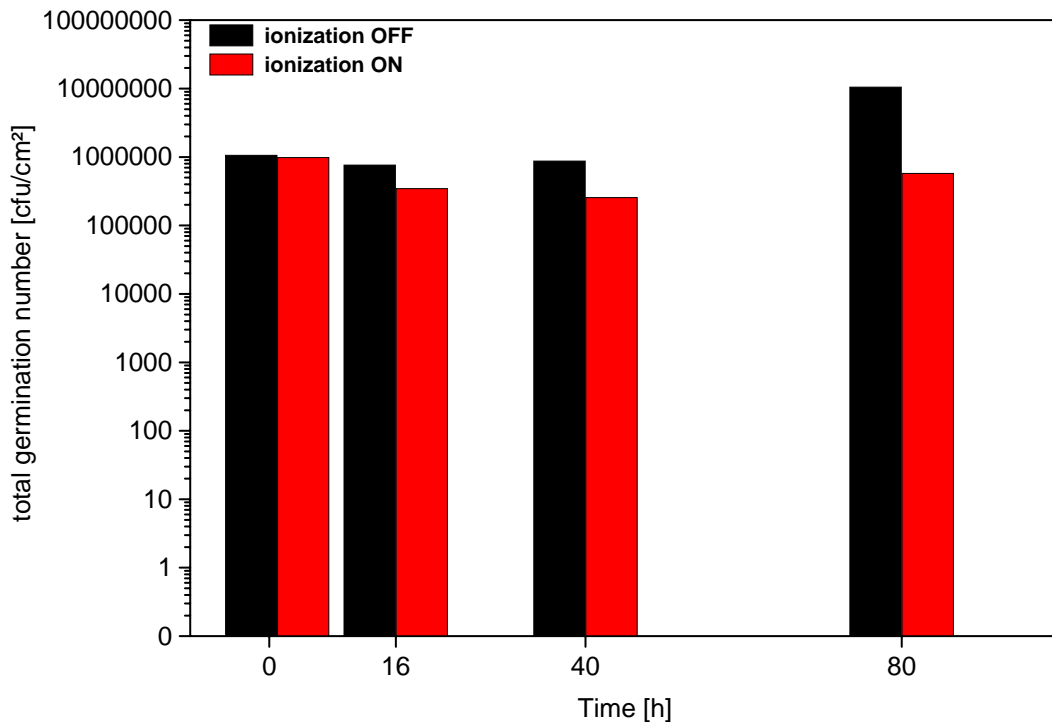
PSEUDOMONAS AERUGINOSA:



Average germination numbers
(Stainless Steel, High Density Polyethylene Chopping Board (Used), PVC Belt)
of PSEUDOMONAS AERUGINOSA

Pseudomonas Aeruginosa encompass a wide group of organisms, many of which are implicated in the spoilage of foods held under chilled conditions. The results show that the untreated samples suffered a initial shock after being swabbed onto the test surfaces. After this the organisms began to grow, showing signs of following a classical microbiological growth curve. By comparison, results with the **aerotec 90** turned on show that the number of decline to extremely low levels.

TREATED CROSS-CUT BEEF:



Average germination numbers of
SALMONELLA AGONA, SHIGELLA FLEXNERI, LISTERIA MONOCYTOGENES, ESCHERICHIA COLI and
PSEUDOMONAS AERUGINOSA

On reviewing the results of the meat samples tested, the main point to be noted is that organisms killed on hard surfaces were found to survive in the meat. That is, the unit is effective in killing organisms on exposed surfaces, provided charged oxygen atoms and ions generated can come in contact with the organisms to be eliminated. However, to compare the results of meats tested under treated and untreated conditions shows that the **aerotec 90** was able to maintain the meat samples with surface loadings at a similar level throughout the 88 hour trial period.