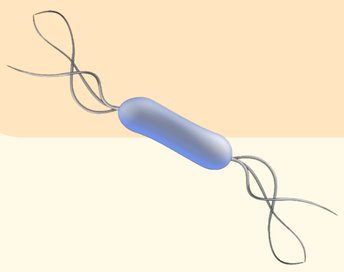
# *Listeria monocytogenes* biofilm adaptation and tolerance to stress conditions: sigma factor contribution.
## A review



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**OBJECTIVES**

-To relate sigma factor with the expression of genetic determinants for resistance to QACs.
-To establish if there's cross resistance between QAC based disinfectants and antibiotics.
-To know how the exposure to sublethal concentrations of QAC-based disinfectant affects the microorganism.

### BIOFILM DISINFECTION

-Biofilm stages: Attachment, EPS development and cell maduration, detachment.
-Cleaning + Disinfection.
-MIC biofilm > MIC free cells

### RESISTANCE TO QAC

-MIC increases in isolated strains after disinfection.
-BAC resistance → Biofilm > Free cells

### SIGMA FACTOR

-Protein needed to start transcription.
-Expression of virulence genes.
-Expression of virulence associated genes.
-Gene expression depends on environmental signals.
-B-Sigma Factor

### *L. monocytogenes*

-Responsible for listeriosis outbreaks, commonly 4b.
-Not particullary resistant but able to form biofilm.
-In 2019 UE cases grown a 31% respect 2018.
-RTE meat (29,6%), dairy (28,4%) and fish (6%).
-Crossed contamination.

### DISINFECTANTS UNDER STUDY

| Compound | Product | Concentration (ppm) | Time (min) | Biofilm reduction (log UFC/cm²) | References |
|---|---|---|---|---|---|
| QAC | Dimethyl ethylbenzyl ammonium chloride (5.1%); Alkyldimethylbenzylammonium chloride (5.1%); Ethanol (1.1%) | 200<br>1000 | 15<br>15 | 5<br>>7 | (Aryal & Muriana, 2019) |
| | Octyl decyl dimethyl ammonium chloride (2.3%)<br>Dioctyl dimethyl ammonium chloride (1.1%)<br>Didecyl dimethyl ammonium chloride (1.1%)<br>Alkyl dimethyl benzyl ammonium chloride (3%) | 100<br>200<br>400 | 1<br>1<br>1 | 2,4<br>3,2<br>3,6 | (Hua et al., 2019) |
| Chlorine Disinfectants | Sodium hypochlorite (<20%); Sodium hydroxide (<5%). | 200<br>1000 | 60<br>15 | <1<br>7 | (Aryal & Muriana, 2019) |
| | Chlorine dioxide | 100<br>200 | 1<br>1 | 2,4<br>3,8 | (Hua et al., 2019) |
| PAA | Peracetic acid (5% –6%), Hydrogen peroxide (25% –58%), Acetic acid (5% –10%) | 500 | 5 | >7,5 | (Aryal & Muriana, 2019) |
| | Peracetic acid (15%) | 80<br>160 | 1<br>1 | 3,6<br>4,8 | (Hua et al., 2019) |

### GENETIC DETERMINANTS TO QAC RESISTANCE

***emrE* Gene**
-emrE protein → efflux pump.
-Removal of *emrE* leads to an increased susceptibility to QACs

***bcrABC* cassette**
-Efflux pump.
-*bcrA* + *bcrBC*.
-Transcription induced by QACs

**Tn*6188* transposon**
-qacH → efflux pump.
-Similarity to *bcrABC* (38-53%)
-Different genetic origin

### CONCLUSION

-More studies are needed to relate cross resistance between disinfectants and antibiotics as to relate sigma factor with *L. monocytogenes* genetic resistance determinants.
-Exposing *L. monocytogenes* to subletahal concentrations of QAC increases the microorganism MIC.

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