INACTIVATION OF *Listeria monocytogenes* BY PULSED UV ILLUMINATION AND PHOTOREPAIR RECOVERY OF UV – DAMAGED CELLS

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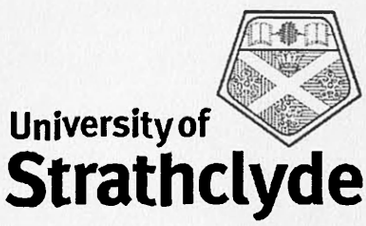

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ABSTRACT

The work presented in this thesis is concerned with an investigation of the effects of ultraviolet radiation on the inactivation and on the subsequent photorepair (photoreactivation) of UV-damage by exposure to longer wavelength light of *Listeria monocytogenes* NCTC 11994 (serotype 4b).

Prior to exposing samples of *Listeria monocytogenes* to UV light, the growth characteristics of *Listeria monocytogenes* NCTC 11994 and NCTC 10357 at different cultivation temperatures (10°C, 20°C, 37°C, 43°C, and 45°C) were established in broth medium. There was no major difference in the growth of *L. monocytogenes* when cultured in static-flask, shake-flask, aerobic fermenter and non-aerobic fermenter. There was also no significant difference between the conventional plate method and the spiral-plate method in enumerating the bacterial populations. Cultivation temperature had a significant effect on the growth rate. The ranking performance of the growth rate for *L. monocytogenes* NCTC 11994 using shake-flask cultivation and spiral plate counting was 37°C > 30°C > 43°C > 20°C > 45°C > 10°C. It was also found that *L. monocytogenes* became more elongated at 45°C and more coccoid at 20°C.

The susceptibilities to pulsed UV-light (PUV) inactivation after growth at different temperatures (10°C, 20°C, 37°C, 43°C and 45°C) and at different population densities (10^4, 10^5, 10^6, 10^7 and 10^8 CFU/ml) were compared. The results clearly showed that the PUV inactivation of *L. monocytogenes* was independent of the prior growth temperature. A significant finding was that stationary phase cells of *L. monocytogenes* exhibited greater resistance to PUV inactivation than those grown to the exponential phase. In a comparative study it was found that the germicidal efficiencies of pulsed 260 nm light on *E. coli* and *L. monocytogenes* were 0.38 log per mJ/cm^2 and 0.26 log per mJ/cm^2, respectively. This demonstrated that *L. monocytogenes* was more resistant to PUV than *E. coli*.

The photoreactivation of *L. monocytogenes* was investigated following initial exposure to pulsed UV light for inactivation and then under three different light sources for photoreactivation. The three light sources used were: a bank of

fluorescent lamps, a pulsed Xenon flashlamp and a continuous Xenon arc. It was found that *L. monocytogenes* possessed an effective light repair mechanism but that dark-repair ability was negligible. The saturation of the photoreactivation effect of *L. monocytogenes* using different light sources was as follows: with the bank of fluorescent lamps, after 20-25 minutes, with the pulsed Xenon flashlamp, after 25 seconds and with the continuous Xenon arc, after 5-10 minutes. The photoreactivation spectrum of *L. monocytogenes* was successfully characterised investigated in the ranges of 300-500 nm only using a continuous Xenon arc. From the spectrum, the highest photoreactivation efficiency occurred within the wavelength region 350-380 nm and the maximum peak of photo-repair was at 380 nm.