Both thermo-labile and thermo-stable lux genes - characterization and comparison of their expression kinetics in batch and continuous culture systems

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Abstract

Two types of luciferase exist, namely thermo-labile, which is active at temperatures below 30°C, and thermo-stable lux (37°C), and originate from marine and terrestrial bacteria, respectively. In this study, both of these operons were fused to the promoters from several oxidative-damage responsive genes (*katG*, *sodA* and *pqi*-5) of *E. coli* and the response characteristics, *i.e.*, the basal and maximum bioluminescence, the relative bioluminescence, kinetics of bioluminescence production, and the post-maximum features, were compared between fusions of the two *lux* operons with the same promoter in both batch and continuous cultures. Strains carrying fusions of the promoters to thermo-stable *lux* showed higher basal levels and maximum induced bioluminescent levels than strains carrying the same promoter fused to thermo-labile *lux*. In batch systems, the sensitivities of most of the strains were found to be similar, regardless of the luciferase used, but lower relative responses were seen from the thermo-stable strains. As well, using the two *katG::lux* fusion strains in batch systems, the bioluminescence from strain DK1, the thermo-stable *lux* fusion strain, was found to be much more stable after reaching its maximum value, while the bioluminescence of strain DPD2511 was transient and decreased very rapidly. In the continuous cultures, however, due to the lower bioluminescence levels seen with the thermo-labile *lux* strains, due to the instability of the *lux* proteins, their sensitivities were generally lower or the strain was non-responsive while all of the thermo-*lux* strains were easily characterized and applicable in the continuous monitoring system.