Specific Responses of Bacterial Cells to Dioxins

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Five different recombinant bioluminescent E. coli strains containing the recA (DNA damage), fabA (membrane damage), katG (oxidative damage), grpE (protein damage) and lac (general toxicity) promoters fused to the lux operon from either Vibrio fischeri or Photorhabdus luminescens, to describe the different mechanisms of toxicity that several PCDDs and PCDF have on bacteria, as well as to determine whether it can sensitively detect their presence. It was found that 2,3,7,8-TCDD caused only DNA damage to bacterial cells. However, the four stress responsive strains showed positive responses after addition of 1,2,3,4-TCDD, while 2,3,7,8-TCDF caused only DNA, oxidative and protein damage. However, 2,8-DD was not found to induce any stresses, indicating that each congener might differentially interact with the cell, stimulating differential stress responses within them. As well, using the constitutive strain, it was found that the level of cellular toxicity experienced due to the addition of these four dioxins decreased in the order of 2,3,7,8-TCDD, 1,2,3,4-TCDD, 2,8-DCDD and 2,3,7,8-TCDF, indicating that 2,3,7,8-TCDD was the most toxic compound tested in this study.