Functional Cell-Array Chip for High-Throughput Analysis of Oxidative Stresses

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Abstract

Analysis of chemicals that cause oxidative toxicity to cells was performed by using a cell-array chip fabricated on acrylic-plate with high-density recombinant bioluminescent bacteria in each well. Twelve recombinant strains carrying oxidative stress responsive promoters of OxyRS/SoxRS regulons were used as sensing components on the chip. A cooled CCD camera is employed to monitor and resolve the bioluminescence signals obtained from each well allowing simultaneous monitoring of bioluminescent responses of all the cells in the array. The capability of the cell chip for analyzing chemical toxicity was examined by using nine chemicals that can be categorized according to their structure and radical production; (a) paraquat, an active radical producer, (b) the structural analogs of paraquat that produce radicals, (c) chemicals that are distinct to paraquat but still produce radicals and (d) chemicals having similar structure as paraquat but do not produce radicals. In spite of structural similarity of chemicals, the bioluminescent responses were critically affected by radical production. Moreover, specific bioluminescence signals were obtained from the cell chips to specific category of chemicals. It means that the cell chip can sensitively respond to even small difference in chemical nature. Finally, a new strategy for analyzing unknown sample to identify its structure and toxicity is proposed based on the unique response obtained from this cell chip.

References

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