Novel Oxidative stress responses Biosensor : *sodA::luxCDABE* fusion *Escherichia coli*

이현주, 구만복 *
National Research Laboratory on Environmental Biotechnology,
Kwangju Institute of Science and Technology(K-JIST)
Tel. (062)970-2454, Fax. (062)970-2434

Abstract

A recombinant bioluminescent *Escherichia coli* strain, EBHJ, (*sodA::luxCDABE*), containing the promoter for the manganese superoxide dismutase (*sodA*) gene fused to the *Vibrio fischeri luxCDABE* operon, was successfully constructed and characterized. Redox-cycling agents, such as paraquat and chromium, strongly induced a *sodA*- regulated response in dose-dependent manners, resulting in an increase of the bioluminescence. In a comparison with an existing oxidative stress responsive strain, DPD2511 (*katG::luxCDABE*), which is sensitive to H 2O2 , the mechanism of chemicals that cause oxidative damage was elucidated via the key transcriptional factors involved in induction of the *sodA* and *katG* promoters, i.e. SoxRS and OxyR, respectively. It was found that responses from the *katG*- and *sodA*-based strains were significantly different dependent upon the chemicals being tested. Therefore, EBHJ, alone or in parallel with DPD2511, can be used to characterize and monitor chemicals that cause oxidative damage.

References

1. Belkin S, Smulski DR, Vollmer AC, Van Dyk TK, Larossa RA, Oxidative stress detection with *Escherichia coli* haboring a *katG::lux* fusion.(1996) Appl Environ Microbiol 62:2252-2256
2. Compan I, Touati D, Interaction of six global transcription regulators in expression of manganese superoxide dismutase in *Escherichia coli* K-12.(1993), J Bacteriol 175:1687-1696
3. Fleming JE, Leon HA, Miquel J, Effects of ethidium bromide on development and aging of Drosophila: implications for the free radical theory of aging.(1981), Exp Gerontol 16:287-293
4. Greenberg JT, Monach P, Chou JH, Josephy PD, Demple B, Positive control of a global antioxidant defense regulon activated by superoxide-generating agents in *Escherichia*

coli.(1990), Proc Natl Acad Sci USA 87:6181-6185

5. Hidalgo E, Nunoshiba T, Demple B, soxRS oxidative stress regulon of *Escherichia coli.*(1994), Methods Mol Genet 3:325-339
6. Imlay JA, Fridovich I, Assay of metabolic superoxide production in *Escherichia coli.*(1991), J Biol Chem 266:6957-6956
7. Min J, Kim EJ, Larossa RA, Gu MB, Distinct responses of a *recA::luxCDABE Escherichia coli* strain to direct and indirect DNA damaging agents.(1999), Mutat Res 442:61-68
8. Obata T, Kubota S, Formation of hydroxyl radicals by environmental estrogen-like chemicals in rat striatum.(2000), Neurosci Lett 296:41-44
9. Pomposiello PJ, Demple B, Redox-operated genetic switches: the SoxR and OxyR transcription factors.(2001), Trends Biotechnol 19:109-114
10. Rupani SP, Gu MB, Konstantinov KB, Dhurjati PS, Van Dyk TK, Larossa RA, Characterization of the stress response of a bioluminescent biological sensor in batch and continuous cultures.(1996), Biotechnol Prog 12:387-392
11. Storz G, Imlay JA, Oxidative stress.(1999), Curr Opin Microbiol 2:188-194