

Development of Biomarkers for the Exposure Assessment of Hazardous Chemical

- Exposure assessment with genetic polymorphism -

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- Abstract -

Cytochrome P-4501A1 (CYP1A1) has been shown to be polymorphic in humans and responsible for the individual differences in hazards to cigarette smoking and polycyclic aromatic hydrocarbon (PAHs). In order to develop the methods for exposure assessment and find susceptibility markers for the industrial workers who were exposed to low doses of benzene, toluene, xylene and other chemicals such as PAHs in petroleum industries, Msp I polymorphisms of CYP1A1 were studied for 289 controls and 225 workers exposed to organic solvents. They could be classified into three types (A, B and C) depending on their CYP1A1 genotypes. The genotypes were determined by restriction fragment length polymorphism (RFLP) of genomic DNA amplified by polymerase chain reaction (PCR). The frequencies of CYP1A1 genotypes A, B and C for the control group (general population) were 33.58%, 56.34% and 10.07% and 41.52%, 47.32% and 11.16% for the exposed group, respectively. The differences in frequencies between the exposed group and control group were not statistically significant ($p > 0.05$). The appearance ratios of CYP1A1 genotypes of control group to exposed group were not affected by

the amount of smoking (day/cigarettes) and duration of smoking and working ($p>0.05$).

These results suggested that the differences in exposure levels to organic solvents, determined by CYP1A1 expression were simple reflection of the degree of the gene expression. The mean concentrations of benzene, toluene and xylene in the air near the workplaces were less than 1/100th of the time weight average (TWA) level and the mean concentrations of metabolites for the solvents, such as phenol, hippuric acid and methyl hippuric acid were also low and less than 1/10th of the biological exposure index (BEI) recommended by the Labor Ministry of Republic of Korea. Thus, the studies on CYP1A1 genotypes with respect to susceptibility for the workers exposed to hazardous chemicals should be further investigated for high, low and all levels of exposure to organic solvents.

Key words : Benzene, Toluene, Xylene, Human lymphocytes, Metabolites, Cytochrome P-4501A1 genetic polymorphism