

## Occurrence and Origin of Mutagenicity in Soil and Water Environment

Tetsushi Watanabe<sup>1\*</sup>, Takeshi Ohe<sup>2</sup> and Teruhisa Hirayama<sup>1</sup>

<sup>1</sup>Department of Public Health, Kyoto Pharmaceutical University,  
5 Nakauchicho, Misasagi, Yamashina-ku, Kyoto 607-8414, Japan

<sup>2</sup>Department of Food and Nutrition, Kyoto Women's University  
35 Kitahiyoshicho, Imakumano, Higashiyama-ku, Kyoto 605-8501, Japan

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Surface soil and surface water are repositories of chemicals released into the environment, and contaminations of surface soil and river water with mutagens were first reported in the 1970s. However, the identity of major mutagens in surface soil and river water remained unclear for more than two decades. Recently, we have identified some nitrated polycyclic aromatic hydrocarbons (nitro-PAHs), e.g., dinitropyrene isomers and 3-nitrobenzanthrone, as major mutagens in the organic extracts of surface soil that showed strong mutagenicities toward *Salmonella typhimurium* TA98 in the absence of a mammalian metabolic system (S9 mix), using a bioassay-directed fractionation method. Moreover, we identified new potent mutagens from substances adsorbed on a blue cotton (blue rayon) from river water samples, which showed strong mutagenicity toward *S. typhimurium* YG1024 with or without the S9 mix. One group was the phenylbenzotriazole (PBTA)-type mutagens, which were detected in river water samples collected at sites below textile dyeing factories. The other group has a dichlorobiphenyl skeleton, i.e., 4-amino-3,3'-dichloro-5,4'-dinitrobiphenyl, and was isolated from a river water sample contaminated with effluent from chemical plants treating polymers and dye intermediates. Some of the nitro-PAHs detected in surface soil, such as PBTA-type mutagens, and 4-amino-3,3'-dichloro-5,4'-dinitrobiphenyl are novel compounds. Up to approximately 50% of the total mutagenicity of extracts from surface soils and river waters was accounted for by nitro-PAHs, PBTA-type mutagens, or 4-amino-3,3'-dichloro-5,4'-dinitrobiphenyl. However, major mutagens in most types of surface soil and river water with high mutagenicity remain unknown. Because environmental mutagens may play some role in the development of diseases such as cancer, their identification is an important step for understanding the risks to indigenous biota and human health. Further effort to identify these major mutagens must be made.

\*E-mail: watanabe@mb.kyoto-phu.ac.jp