

Study on New Bioassay Methods for Sewage Treatment Water

Whole term

1995.11 ~ 1996.2

(Purpose)

Recent studies have revealed that, in reality, various kinds of micro-pollutants are emitted to the environment and the water environment resulting in their pollution. However, it is impossible to measure all these pollutants individually along with the synergistic effects in between themselves. Thus, various kinds of indexes have been studied for their integrated evaluation.

Among these indices, bioassay method is considered to be effective in evaluating complex and synergistic pollutions, thus being studied especially for the integrated evaluation of water pollution.

In the Public Works Research Institute, various kinds of bioassay methods are being studied to evaluate the safety of treated wastewater quality. As a part of the study, bioassay using mutagenicity test was conducted.

This study aims to establish a safety evaluation method for treated wastewater. Basic discussions on the techniques and evaluation methods were conducted through testing actual treated wastewater samples with the several mutagenicity test methods, which were selected from various kinds of mutagenicity tests studied for the safety evaluation of water environments.

(Outline of study)

The following items were examined in the study conducted from 1992 to 1995.

- (1) mutagenicity tests using microorganisms
- (2) sample concentration methods
- (3) mutagenicity tests using actual treated wastewater samples (concentrates of treated wastewater from two plants) and standard reference materials

(Results)

- (1) Resin absorption concentration method using Sep-Pak C-18 and methanol as a re-elution solvent was selected as a concentration method for mutagens.
- (2) Mutagenicity testes were conducted using Rec-Assay, umu-test and umu-rac. Umu-test showed the highest detection sensitivity and was considered as the most appropriate test method.
- (3) Umu-test requires fixed test conditions, such as fixed fungi activity. Thus, the test method was established in details.
- (4) As the result of testing 667 times concentrated treated wastewater from two plants, it was observed that mutagenicity was positive in both cases of metabolic activator S-9 mix (+) and (-) for a plant and only S-9 mix (+) in another. Consequently, it was suggested that different mutagens were detected in the two plants.
- (5) In this study, the results of umu-test were analyzed only qualitatively and not quantitatively considering the concentration magnification. In order to assess the impact on the environment, quantitative evaluation is also necessary.

When the mutagenicity is positive under such high concentration magnitude, it does not necessarily mean that, it affects the environment, humans or any other organisms other than the fact that, the mutagenicity is positive for the bacterium.

Therefore, further study is needed on quantitative evaluation methods considering the impact assessment on human and other organisms based on the suggested methods, such as quantitative evaluation by comparison with standard reference materials or VSD (Virtually safety dose) where a substance is judged substantially safe when the risk by intake throughout one's life time is lower than a certain very low risk value.

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Keywords

Mutagenicity test, Rec-Assay, umu-test, umu-rac, resin absorption concentration method