

Necessity of Adopting Bioassay in Water Environment Management

- a case study of the petrochemical industry's effluent –

Makoto Kaneko

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1. INTRODUCTION

Many chemical substances have been used for their benefits. However, toxic substances pollute the water environment, therefore their long-term risk has been increasing. In order to prevent water pollution from chemical substances, the regulations of chemical substances are needed, and at the same time, monitoring of water toxicity by bioassay may be useful. In this research, the necessity of introducing bioassay for water environment management was discussed through a case study of the petrochemical industry's effluent.

2. REGULATION AND ISSUES OF CHEMICAL SUBSTANCES

The measures for chemical substances in Japan focus on the protection of human health, while the environmental discharge is not well-considered. Though the Japanese government has conducted surveys on the actual condition of chemical substances since 1970's, it is impossible to investigate tens of thousands of chemical substances in the environment. Thus, measures for assessing water toxicity are needed in addition to the regulation of chemical substances. The bioassay is one of the most effective methods to evaluate water toxicity.

3. SUMMARY OF EXPERIMENTS

Rec-assay and a yeast reporter gene assay were selected because they are cost-effective, may be finished in a short-time, and multiple samples can be analyzed concurrently. Rec-assay is a toxicity assay for evaluating DNA damage, and the yeast reporter gene assay is a ligand-receptor binding assay for detecting dioxin-like compounds. Samples from a wastewater treatment plant treating petrochemical industry's effluent, including the influent water of wastewater treatment plant, influent water of oil flotation tank, influent water of conditioning tank, influent water of primary settling tank, influent water of aeration tank, influent water of final setting tank, influent water of chlorination and the final effluent, were tested by using the two bioassays.

4. RESULTS AND CONCLUSION

Rec-assay detected DNA-damaging substances in the influent water and final effluent. Those substances were reduced during treatment process but still found in the final effluent. The yeast reporter gene assay detected at least two groups of active substances showing dioxin-like activity. One group lost their activity during treatment process but the other group still elicited activity in the final effluent. These results showed the possibility of releasing toxic substances into the water environment. In this research, bioassay was demonstrated to be very effective in evaluating water toxicity, and thus the toxicity reduction method must be adopted.