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Algal growth inhibition by river water pollutants in the agricultural area around Lake Biwa, Japan

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"Capsule": *Low-cost bioassays can be used to prioritize samples for pesticide analysis.*

Abstract

An ecotoxicological study of river water discharged from the agricultural area around Lake Biwa was performed by using algal bioassays to guide chemical analysis. Water samples were collected once a week, at least, for 1 year starting in April 1997 and continuing until April 1998. The toxicities of the dissolved and particulate-adsorbed extracts of water samples were evaluated by the algal growth inhibition test and concentrations of individual pesticides were determined. Most of the river water that was collected during the periods when pesticides were applied to the paddy fields caused algal growth inhibition. Some extracts were found to contain herbicides (molinate, mefenacet, simetryn, or esprocarb) as major compounds. According to chemical assay and bioassay, simetryn was identified as the most toxic compound that caused algal growth inhibition.

Keywords: Algal bioassay; Herbicide; Lake Biwa; Runoff; Simetryn

1. Introduction

Agrochemicals such as pesticides and fertilizers are used throughout the world to increase crop production. These substances are considered to be contaminants in aquatic environments whether well-regulated or not. The widespread use of pesticides on farmland often leads to their presence in freshwaters and marine coastal environments. The transport of pesticides from treated soils to water bodies is a result of two dominant mechanisms: waterborne runoff, and direct deposition from the atmosphere. The former is probably the most significant for chemicals such as s-triazine herbicides that have high water solubility and low vapour pressure (Gaggi et al., 1995).

Chemical analysis is a powerful tool to evaluate the quality of runoff from agricultural land if the individual compounds responsible for the impairment of the water quality can be identified and detected. In contrast, bioassays can be used to evaluate the toxicity of the sample as a whole. Bioassay results can be used to identify more quickly and reliably the most toxic areas, thereby helping to select sites for more thorough evaluation, including the direction of chemicals analysis (Keddy et al., 1995).

We have evaluated the ecotoxicity of water discharged from agricultural land around an artificial lake (Lake Kojima) by using a combination of bioassays and chemical analyses (Okamura et al., 1996, 1999). The chemical analyses taken around Lake Kojima were guided by the results of bioassays, which indicated that the pesticides in the runoff caused immobilization of daphnia (*Daphnia magna*). Therefore, it was considered valuable to apply the same approach to other environmental samples. The water resources of Lake Biwa, which is the largest lake in Japan, have been used as a source of drinking water for all the residents, 14 million people, living downstream of the lake. Hence, keeping the quality of water in this lake is important. To date, studies of the water quality of both the lake and the inflowing rivers have been conducted mainly by chemical

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