

以密閉式藻類毒性試驗評估農藥之單一及混合效應

學生：葉徽君

指導教授：陳重元

國立交通大學環境工程研究所

摘要

傳統藻類毒性試驗法（批次式試驗）對於有機物，特別是揮發性有機物的毒性測試並不如其他標準方法（魚類，水蚤）敏感。本研究以藻類（*Raphidocelis subcapitata*）利用 BOD 瓶進行一密閉式系統之毒性試驗，評估七種農藥之單一及混合毒性；藉此改良之藻類毒性試驗法分別偵測兩種反應終點：細胞生長率及溶氧產生量，而與批次式藻類、魚類以及水中微生物等毒性試驗法相比較。結果顯示出對單一毒性物質而言，密閉式藻類毒性試驗法大致上為較敏感之方法，並能有效測試出具揮發性農藥之毒性，改善了批次式藻類毒性試驗法在此方面之缺點。此外，本研究以應用統計學上的中斷值（cut-off value）作為選擇 NOEC 或 EC10 的客觀參考點，結果顯示 NOEC 比 EC10 提供生物更嚴謹的保護標準。

對於混合毒性效應研究中，主要以溶氧為反應終點，混合的實驗組數約有 15 組。其中得到協同作用（Synergistic），約佔了一半的反應情形，相加作用（Additive effect）與拮抗作用（Antagonism）各佔了剩下的一半，其中所出現協同作用較為明顯，與過去文獻結果相呼應。並由實驗了解，在混合實驗中，常會因為選擇的反應參數不同或混合比例的差異，所產生的毒性效應不盡相同；這可能與化學物質在生物體內的作用機制有所關聯，需更進一步探討。

Toxicity assessment of pesticides using a closed-system algal test

Student : Huei-Jiun Yeh

Adviser : Chung-Yuan Chen

Institute of Environmental Engineering

National Chiao Tung University

ABSTRACT

The purpose of this research is to compare the results of seven pesticides on freshwater aquatic toxicity tests, and evaluate the joint action of these toxicants with each other. This research has present that the sensitivity of standard algal toxicity test (Batch tests) on pesticides, especially on volatile organic compound is less receptive than other toxicity test method, such as algae, fish or water fleas toxicity test. Furthermore, this experience reveals that by using a closed-system on algal toxicity test can enhance the sensitivity on testing volatile pesticides, and prove the default on Batch tests. In addition, a cut-off value approach is proposed to determine whether NOEC or EC10 should be chosen for estimating low toxic effects. The results indicate that NOEC offers better protection to test organisms than EC10.

Another interesting finding is that the joint toxicity of complex mixtures. There are 15 sets of tests. There are about 46.7% on synergistic joint actions were identified. Then, other combined effects were additive or antagonistic. As the information, the synergism is significantly presented, which is similar actions on the literature data. There is consideration that tests using different endpoints or different mixture contents might result in diverse responses. It is speculated of the reason in the biochemical action of pesticides to organism, and worthy of discussion in the future.