行政院環境保護署 環檢所 委託計畫

計畫名稱：環境荷爾蒙調查研究
計畫編號：EPA-92-E3S5-02-01
計畫執行單位：大仁技術學院環境工程與科學系
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計畫期程：92年01月15日起92年12月31日止
計畫經費：1425千元

摘　要

依今年度計畫工作目標之要求分化學分析及生物效應分析等兩部分，化學檢測部分除於高屏溪流域及沿海採集真實環境檢體水樣及底泥樣品外，需另加民生用品之部分進行壬基酚或三丁基錫的含量分析，壬基酚項目共完成之樣品數：溪流水樣44個、地下水20個，底泥10個，民生用品中洗滌劑4件、乳化劑3件，總共81個樣品；三丁基錫項目共完成之樣品數：沿海水樣20個，底泥6個，魚肉9件，漁網4件總共39個樣品。綜合化學分析工作總樣品數共120個，超過原定之工作目標。

壬基酚項目在溪流樣品、底泥、乳化劑檢出率皆100 %，水樣測值介0.19~183.4μg/l，底泥測值介134.7-354.4 ng/g，乳化劑測值介1.9-13.4- mg/g，部分測站水樣壬基酚測值高於國內外文獻資料，底泥測值則略低於國內北部地區的數據。地下水樣品壬基酚與類雄激素效應的檢出率皆為0 %。

三丁基錫項目水樣檢出率25 %、底泥檢出率83.3 %，水樣測值介＜0.0026~83.2 ng/l，底泥測值介＜1.24~72.39 ng/g，，以汕尾漁港的測值明顯高於其他測站。魚肉樣品檢出率100 % ，測值介26.4~194.2 ng/g；此三類樣品的測值與文獻資料差異不大，另廢棄漁網的檢出率0 %，未見三丁基錫的殘留。

84個樣品以兩種生物效應檢測技術：一為利用人類乳癌細胞株 MVLN雌激素專一性轉錄分析法，探討雌激素效應物質之篩選，另一為採用MCF7-AR1細胞，探討雄激素效應物質之篩選，並於高屏溪流域採集84個樣品，進行真實環境樣品之檢測，驗證了此兩種生物分析法，應用在環境議題上的可行性。原水樣雌激素效應分析，依Soto分類系統顯示樣品中屬full agonist的佔4.8 % ，partial agonist的佔7.1 % ；反觀雄激素效應則partial agonist的佔4.8 % 但無full agonist，但若經濃縮處理後則雌、雄激素效應都明顯上升，因此水體品質之安全性需進行長期監控。

今年度對壬基酚與三丁基錫兩物種的風險評估，也提出一些資料，也依實際環境檢體之測值與國際組織所設定的預期無效應濃度(PNEC)作生態風險評估，對人類族群則採用MOS（安全限值，估計無效應濃度/暴露濃度）。整體而言今年度，水樣及底泥

NP的含量對水中生物及底棲生物可能造成潛在風險；至於TBT部分尚須更多的檢體以確定對水生生物的潛在風險。

英文摘要

Water and sediment samples were taken along the Kaoping River and estuary for Nonylphenol (NP) and tribulytin (TBT) chemical analysis and bioassay to fulfill the requirements of our project. In addition, fractions of household commodities were also analyzed. . Eighty-one NP test samples were gathered: 44 from river water, 20 from groundwater, 10 from sediment, 4 from household commodities, and 3 from emulsion agent. Thirty-nine TBT test samples were obtained: 20 from seawater, 6 from sediment, 9 from fish muscle, and 4 from a fishnet. In total, 120-samples were collected, exceeding the working objective of this year.

The NP analytic results showed that the water, sediment, and emulsion agent samples contained0.19~183.4 μg/l, 134.7-354.4 ng/g, and 1.9-13.4 mg/g NP, respectively. The NP concentrations of some waste samples were greater than values reported in domestic and other countries. The NP concentrations of sediment were slightly less than values reported in northern Taiwan. The groundwater samples did not show both NP content and estrogenic activity.

The TBT analytic results showed that 25% of the samples contained TBT. Sediment samples contained 83.3% TBT. The concentration of TBT for water samples and sediment were ＜0.0026~83.2 ng/l，and ＜1.24~72.39 ng/g. The TBT concentration in the fishing port of Shann-Wei was much greater than in other sampling locations. Samples of fish muscle contained 100% TBT residuary that reached a concentration between 26.4 and 194.2 ng/g. The detected concentrations of these three kinds of samples were not much different from those reported in the reference. However, the fishnet showed no residuary of TBT.

Eighty-four samples were analyzed by two different bioassay methods. One method used a human breast cancer cell line MVLN estrogen specific transcription assay to investigate estrogenic activity substance of the samples. The other one took an MCF-AR1 cell line to examine androgen-like substances. These 84 samples taken from Kaoping Rive were analyzed by both bioassay methods, which verified the applicability of both methods to real environmental samples. The estrogenic activity analysis showed that 4.8% of the samples were fully agonist and 7.1% of the samples were partially agonist.

Androgen activity analysis showed that 4.8% of samples were partially agonist and none of the samples were fully agonist. If these samples were concentrated, both estrogenic and androgenic activity would be raised significantly, which indicates a need for (?) long-term monitoring for the safety of water quality.

Both NP and TBT testing were begun with a risk assessment. The measured concentration was divided by a Predicted No-Effect Concentration (PNEC) reported by an international organization to obtain an ecotoxicity hazard quotient. Human risk characterization was evaluated for a Margin of Safety (MOS) that accepted daily intake/measured daily intake. Generally, the results of risk characterization showed that the levels of NP in both water and sediment might cause potential risks to aquatic and benthonic organisms. However, more samples were needed to verify potential TBT risk.