

## Technical note

# Determination of insecticide residues in groundwater of Mardan Division, NWFP, Pakistan: A case study

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## Abstract

Insecticide residue values in groundwater samples from Mardan Division, North-Western Frontier Province, Pakistan, are reported in this paper. The samples were extracted with dichloromethane and analysed on a gas chromatograph equipped with an electron capture detector (ECD-<sup>63</sup>Ni) using a capillary column. Contamination levels in all sites were found to be below the maximum acceptable concentration (MAC) set by the European Community (EC), except for three sites namely Amber, Swabi (0.82 µg/l), Lahore Shakh, Chota Lahore (0.50 µg/l) and Madras Kalay, Mardan (0.64 µg/l). Correlation between water depth and insecticide residues was ill-defined. Loss in recovery due to the matrix effect was found to be 10 to 20%.

## Introduction

Pakistan uses insecticides for food production and for control of vector-borne diseases in the public health sector. Here the insecticide levels have increased from 665 M.T. a.i. in 1980 to 24868 M.T. a.i. in 1994 (Agricultural Statistics of Pakistan, 1994-1995). These insecticides can find their way into the groundwater through leaching, channelling (downward percolation), direct spillage and wind drift. Insecticide residues in drinking- and groundwater of developed countries like the USA (Bushway et al., 1992; Molto et al., 1991), France (Legrand et al., 1991), Australia (Ang et al., 1989) and Denmark (Felding, 1991) have been reported. In Pakistan, Parveen and Masud (1988) have detected some chlorinated insecticides in cattle drinking water from Karachi while Jabbar et al. (1993) reported monocrotophos, cyhalothrin, and endrin in shallow groundwater of Faisalabad, the cotton-growing area of the country. Results of insecticide residue analyses of groundwater or drinking-water samples from the areas of North-Western Frontier Province (NWFP) have so far not been reported.

Currently organophosphate (OP) insecticides are used since most of the organochloride (OC) insecticides have been banned because of their toxicity, persistence and bioaccumulation in the environment (Molto et al., 1991). Tobacco, sugar-cane and maize are the main crops of Mardan Division where substantial amounts of insecticides per cropping season are applied. The widespread use of toxic insecticides has created a need for their monitoring in water, soil and food commodities of this area. Illiteracy in farmers, indiscriminate use and adulterated insecticides pose a potential threat to local inhabitants. In this study insecticide residues in groundwater of Mardan Division were determined. Twelve sites were sampled. These sampling points are indicated in Fig. 1.

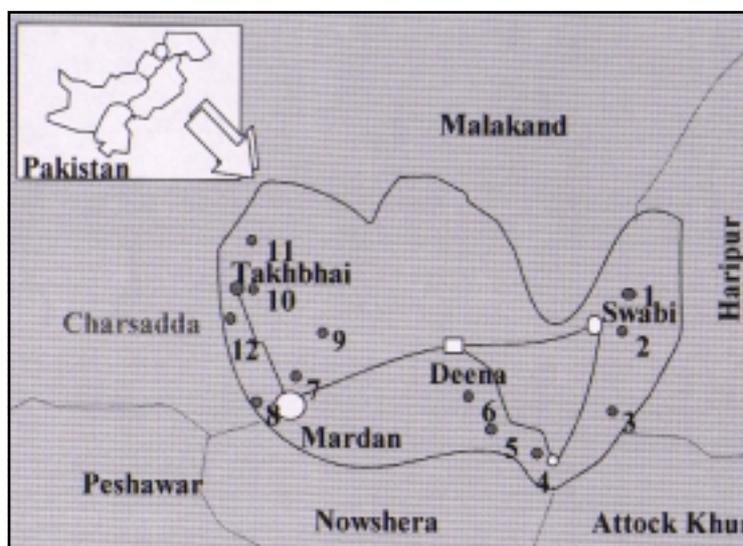


Figure 1

Groundwater sampling sites in Mardan Division, NWFP, Pakistan

## Reagents

Insecticide standards, dichlorvos, mevinphos, dimethoate (99.9%), gamma-BHC (99%), methyl parathion (99.2%), fenitrothion, chlorpyrifos, endosulfan (99.5%) and profenphos were supplied by the Danish Institute of Plant and Soil Sciences, Department of Weed Control and Pesticide Ecology, DK-4200 Slegelse, Denmark and the Tropical Agricultural Research Institute (TARI), PARC Karachi. GPR grade dichloromethane (BDH), HPLC grade ethyl acetate (BDH) and anhydrous Na<sub>2</sub>SO<sub>4</sub> (Riedel-deHaën) were used.

## Apparatus

A gas chromatograph, Autosystem, Perkin Elmer, equipped with <sup>63</sup>Ni electron capture detector (ECD), splitless injector, capillary

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