

# Organochlorine Pesticide Accumulations in Groundwater of Seydisuyu Basin (Eskişehir, TURKEY)

Arzu CICEK, Cem TOKATLI, Esengul KOSE

**Abstract**— Seydisuyu Basin, which is located in the Eskişehir province of Turkey, contains very important agricultural lands. In this paper, the total organochlorine pesticide levels in groundwater of Seydisuyu Basin were investigated by determining Alfa HCH, HCB, Beta HCH, Gama HCH, Aldrin, Cis Heptachlorepoxide, Trans chlordane, Cis chlordane, Dieldrin, 44DDE, Endrin, 44DDD, 44 DDT, Metoxyclor and pesticides with Endosulfan in water samples. Groundwater samples were collected seasonally (2011 – 2012) from 29 wells from the Seydisuyu Basin. According to data observed, although groundwater of the Basin has I. - II. Class water quality in terms of total pesticide concentrations in general, organochlorine pesticide accumulations of some wells were higher than the drinking water limits specified by Turkish Standards Institute (TS266).

**Keywords**— *Seydisuyu Basin, Organochlorine Pesticides, Drinking Water.*

## I. Introduction

As it is known that 2.8 percent of earth's water is fresh and suitable for human consumption and 30.1% percent of the these freshwater is located in underground as groundwater, which is an important source of drinking water for many people. Rapid growth of world population and extreme developments of industry cause significant decreases of limited freshwater potential of the world [1, 2, 3].

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Arzu Cicek  
Anadolu University, Applied Environmental Research Centre  
Eskişehir, Turkey

Cem Tokatli  
Trakya University, Ipsala Vocational School  
Edirne, Turkey

Esengul Kose  
Eskişehir Osmangazi University, Osmangazi Vocational School  
Eskişehir, Turkey

Organochlorine pesticides (OCPs) are being used commonly in agricultural applications against pests. They are also being used in household, garbage heaps, waste disposal sites, sewers, godowns, etc. OCPs may enter to the groundwater through diffused and point sources. Large intake of water contaminated with low concentrations of pesticide residues may cause significant effects in consumers [4, 5].

Seydisuyu Basin is located in the Eskişehir province and contains very large and productive agricultural lands. The aim of this study was to determine the OCPs levels in groundwater of Seydisuyu Basin and to evaluate the groundwater quality of the system.

## II. Material and Method

### A. Study Area and Collection of Samples

Seydisuyu Basin that is one of the most important agricultural lands of Turkey is located in the Central Anatolia Region between the locality of 38.0851 – 39.0361 north latitude and 30.0161 – 31.0071 east longitudes [6].

Groundwater samples were collected seasonal periods in 2011 – 2012 from 29 wells that are using for drinking and irrigation water in the basin. The volume of one liter groundwater samples were taken at each sampling point (well). Coordinates and localities of stations are given in Table 1 and the map of study area is given in Figure I.

### B. Chemical Analysis

Groundwater samples were collected in the pre – cleaned, oven – dried, hexane – rinsed, amber – colored bottles of one liter capacity. Than they were sealed with screw caps lined with aluminum foil immediately. Organochlorine pesticide (OCPs) analyses of groundwater samples were determined according to liquid-liquid extraction method of EPA (Environmental Protection Agency) by using Shimadzu QP2010 Plus GC / MS device (EPA Method 508).

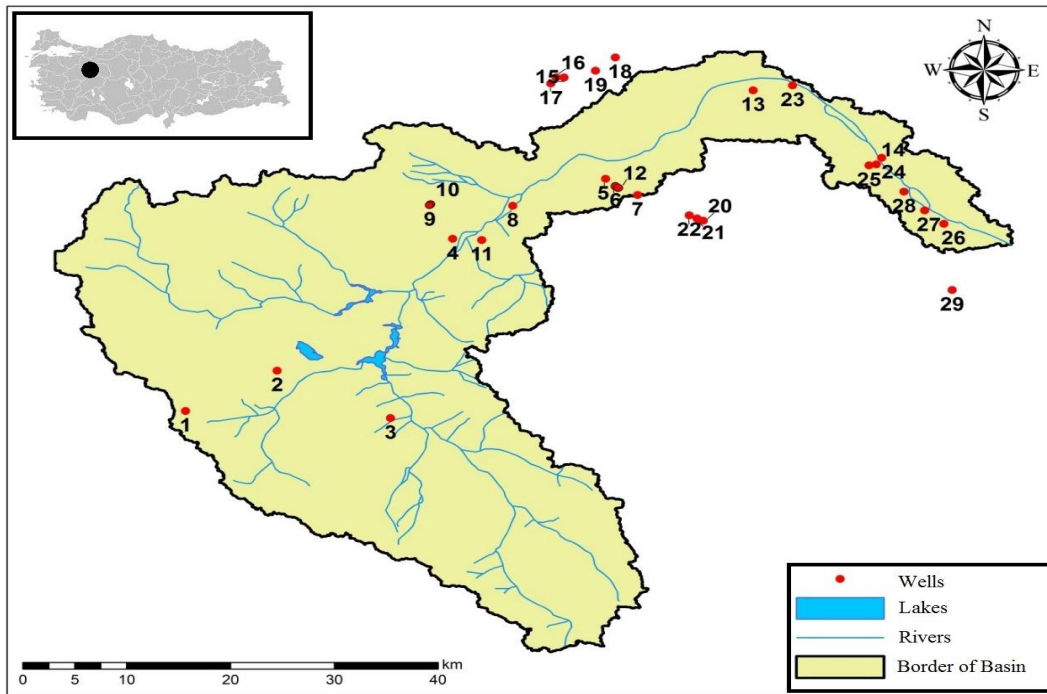


FIGURE I. Map of study area

TABLE I. LOCATION PROPERTIES OF SELECTED STATIONS

Stations	Coordinates	Ground Elevation (m)	Intent of Use
Well 1	N: 39.23589° E: 30.39845°	1246	Drinking
Well 2	N: 39.27687° E: 30.47783°	1079	Drinking
Well 3	N: 39.22866° E: 30.57604°	1058	Drinking
Well 4	N: 39.41094° E: 30.62988°	974	Drinking
Well 5	N: 39.47202° E: 30.76241°	957	Irrigation
Well 6	N: 39.46468° E: 30.77084°	955	Irrigation
Well 7	N: 39.45549° E: 30.79006°	954	Irrigation
Well 8	N: 39.44451° E: 30.68197°	956	Drinking
Well 9	N: 39.44612° E: 30.61080°	1048	Irrigation
Well 10	N: 39.44539° E: 30.61011°	1040	Irrigation
Well 11	N: 39.40977° E: 30.65513°	993	Drinking
Well 12	N: 39.46267° E: 30.77316°	955	Drinking
Well 13	N: 39.56195° E: 30.89019°	941	Drinking
Well 14	N: 39.56880° E: 30.99699°	882	Drinking

TABLE I. CONTINUED

Stations	Coordinates	Ground Elevation (m)	Intent of Use
Well 15	N: 39.57503° E: 30.72636°	942	Irrigation
Well 16	N: 39.57508° E: 30.71961°	945	Irrigation
Well 17	N: 39.56880° E: 30.71499°	947	Irrigation
Well 18	N: 39.59535° E: 30.77084°	923	Irrigation
Well 19	N: 39.58183° E: 30.75366°	932	Irrigation
Well 20	N: 39.42939° E: 30.84706°	923	Irrigation
Well 21	N: 39.43160° E: 30.84162°	927	Irrigation
Well 22	N: 39.43488° E: 30.83485°	937	Irrigation
Well 23	N: 39.56689° E: 30.92443°	899	Irrigation
Well 24	N: 39.49333° E: 31.00157°	884	Irrigation
Well 25	N: 39.48563° E: 30.99065°	886	Irrigation
Well 26	N: 39.42622° E: 31.05550°	870	Irrigation
Well 27	N: 39.43978° E: 31.03883°	872	Irrigation
Well 28	N: 39.45891° E: 31.02101°	875	Irrigation
Well 29	N: 39.35887° E: 31.06268°	873	Drinking

### III. Results and Discussion

The total organochlorine pesticide (OCPs) levels by determining Alfa HCH, HCB, Beta HCH, Gama HCH, Aldrin, Cis Heptachlorepoxide, Trans chlordane, Cis chlordane, Dieldrin, 44DDE, Endrin, 44DDD, 44 DDT, Metoxyclor and pesticides with Endosulfanin were investigated in groundwater of Seydisuyu Basin seasonally. The annual averages of detected OCPs accumulations in groundwater samples are given in Figure II.

According to results of this study, the OCP concentrations in groundwater of Seydisuyu Basin were recorded between the values of 0.065 – 1.486  $\mu\text{g/L}$ . The lowest levels of OCPs were determined in Well 28 that is being used for irrigation water and the highest levels of OCPs were determined in Well 2 that is being used for drinking water.

According to data observed, although groundwater of the Basin has I. – II. Class water quality in terms of total pesticide concentrations in general, organochlorine pesticide accumulations of some wells were higher than the drinking water limits specified by Turkish Standards Institute.

According to the Water Pollution Control Regulation criteria in Turkey [7], all the investigated stations have I. Class water quality in terms of total pesticide parameter ( $< 1 \mu\text{g/L}$ ) except the stations of Well 1, Well 2 and Well 4. These stations have II. Class water quality in terms of total pesticide parameter ( $> 1 \mu\text{g/L}$ ).

According to drinking water standards specified by Turkish Standards Institute [8], total pesticide accumulations in groundwater of Well 1, Well 2, Well 3, Well 4 and Well 16 stations were higher than the drinking water limits ( $> 0.5$ ) and dangerous for human health. The OCPs levels recorded in Well 2 that is being used for drinking water were about three times higher than the drinking water limits. As it is known that lipid solubility and bioaccumulation of low concentrations of organochlorine pesticides in the body fat of mammals pose significant potential hazards in the long term exposures [5].

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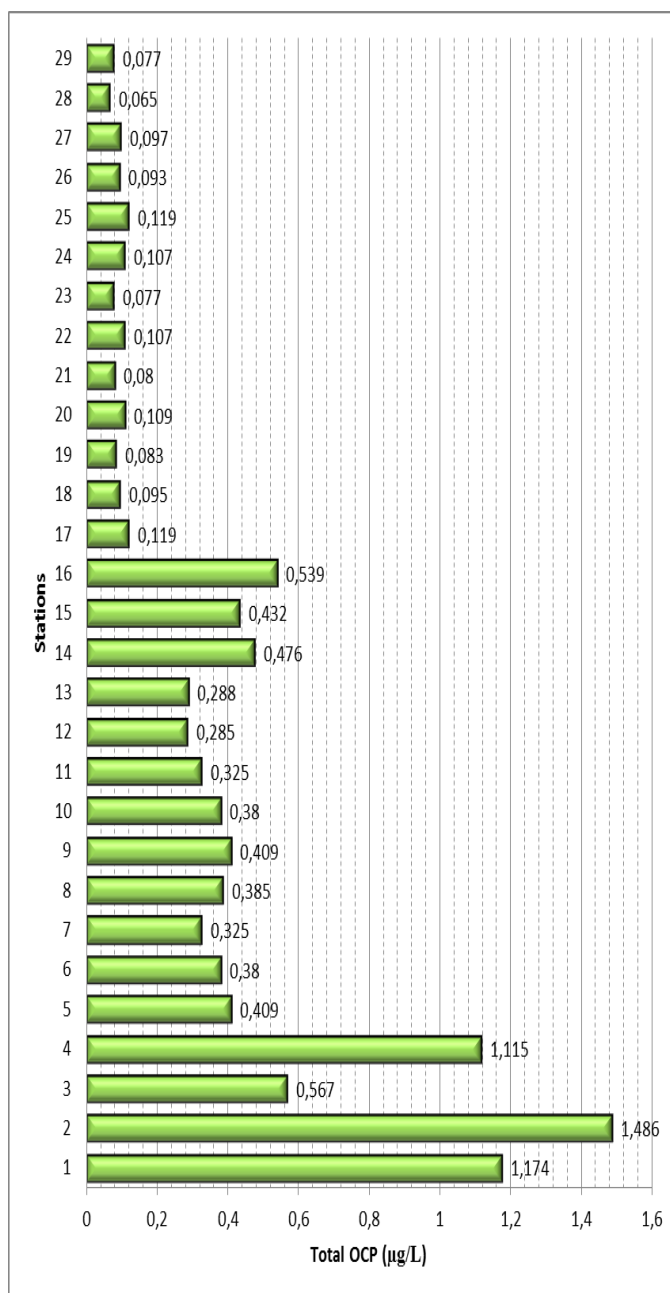


FIGURE II. Levels of organochlorine pesticides in groundwater

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About Author (s):

	<b>First Author</b> (Arzu Cicek) has many studies on water – sediment quality of freshwater ecosystems and geographic information systems. Currently she has been serving as teaching staff (Prof. Dr.) at the Anadolu University.
	<b>Second Author</b> (Cem Tokatlı) has many studies on statistical ecosystem evaluation, biyo ecological indices and diatoms. Currently he has been serving as teaching staff (Assist. Prof. Dr.) at the Trakya University.
	<b>Third Author</b> (Esengul Kose) has many studies on heavy metal accumulations in lotic - lentic freshwater ecosystems. Currently she has been serving as teaching staff (Assist. Prof. Dr.) at the Osmangazi University.