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Chlorinated Pesticides and Heavy Metals in Streams and Lakes of Northern Mississippi Water

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North Mississippi is mainly an agricultural area where pesticides are used extensively to protect cotton, soybean and corn crops. Because of the possible harmful effects of the chlorinated pesticides to the environment, a research program was initiated at Rust College in 1972 to determine the quality and quanity of these pesticides residues in the water of the lakes and streams and to study heavy metals and other chemical pollutants in the area. The survey covered ten sampling sites selected to represent the bulk of water under investigation. Two gallon samples were collected at a depth of one foot using a "Lamotte Chemical" water sampling bottle #1060 and the technique employed is that recommended by Millipore Application Manual (1972) Fig. 1.

ANALYSIS

Several physical and chemical parameters were determined immediately on the sampling site using DR-EL Series of Portable Water Engineer's Laboratories Instrument manufactured by Hach Chemical Company of Ames, Iowa. Results are shown in Table 1 indicating no serious pollution resulting from these ions.

MERCURY AND LEAD ANALYSIS

Analysis of water soluble heavy metal ions, lead and mercury was performed on the water samples collected. A Varian Model 1100 Atomic Absorption spectrophometer was used for the analysis of lead. The procedure followed was that recommended by Varian Manual (1972) and results indicate lead concentration below pollution levels in all ten samples (Table 1). At the same time, mercury was determined using Coleman Model 50 mercury analyzer and there was no evidence of mercury pollution in these samples (Table 1). These results are in line with our early prediction of possible absence of lead and mercury pollution in this area because of its agricultural nature. The only source of mercury would be methylmercury compounds used as fungicides for seeds treatment. The absence of lead pollution could also be explained by the absence of major interstate highways and industrial plants.

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TABLE 1

Physical and Chemical Analysis of Northern Mississippi Water

Sample No.	Temp. ^{o}C	Hard-ness Mg/l	Iron Mg/l	NO_3^- Mg/l	Dis-solved Mg/l	PH	PO_4^{-3} Mg/l	Silica Mg/l	SO_4^{-2} Mg/l	Chloride Mg/l	Carbon-ate Mg/l	Lead* PPb	Mercury** PPb
1	23	31.25	0.61	0.01	8.00	6.69	0.48	2.28	0.60	12.50	6.80	28.00	0.32
2	24	20.00	2.00	0.41	7.00	6.53	3.60	2.25	0.01	12.40	10.00	16.00	0.22
3	25	12.50	1.55	4.00	7.00	6.93	0.18	12.40	12.00	6.25	15.00	9.00	0.25
4	24	25.00	0.98	2.10	7.00	6.48	0.32	2.25	10.20	9.38	7.50	30.00	0.27
5	25	20.00	1.15	3.00	8.00	6.80	0.55	6.80	18.00	8.50	16.00	20.00	0.27
6	24	37.50	2.00	2.10	6.00	6.41	0.91	2.25	50.00	21.88	10.00	36.00	0.29
7	23	25.00	0.98	2.20	7.00	6.32	0.62	9.50	53.00	10.00	10.80	30.00	0.23
8	23	65.00	1.15	1.00	6.00	6.47	0.60	17.80	9.00	20.00	16.00	9.00	0.23
9	24	31.00	0.77	2.00	8.00	6.85	0.43	2.25	15.00	7.50	18.75	25.00	0.31
10	23	25.00	1.19	2.10	8.00	6.67	0.38	2.02	10.20	9.38	7.50	18.00	0.41

*Determined by Atomic Absorption

**Determined by Coleman Mercury Analyzer

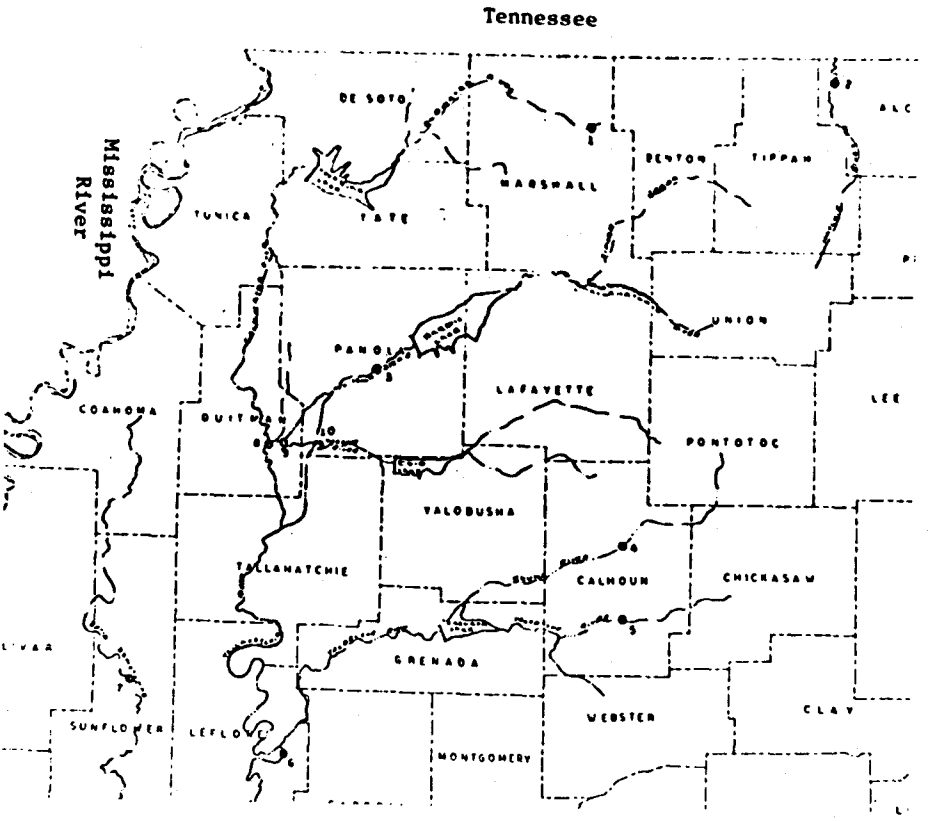

Figure 1
Map of Sampling Area in Northern Mississippi

PESTICIDES EXTRACTION

900 ml of the water sample was poured into a large separatory funnel and chlorinated pesticides were extracted by 75 ml hexane (pesticide grade) in three successive extractions. The hexane layer was separated and dried out over anhydrous sodium sulfate. The extract was poured into a Kuderna-Danish Concentrator and evaporated to one ml volume (Mills Method).

PESTICIDES ANALYSIS

A Varian gas chromatograph 1400 series with Ni (63) electron capture detector was used. The samples were analyszed by two columns, a 6 ft. stainless steel column packed with 1.5% O.V. on 80-100 mesh celite and a glass 6 ft. packed with 5% S.E. on celite 100-120 mesh column.

The first one was purchased from Supelco, Inc. of Bellanfonte, Pennsylvania and the second was provided by Varian as a trial column. Dry nitrogen was used as carrier gas and a typical chromatogram obtained is presented in Figure 2.

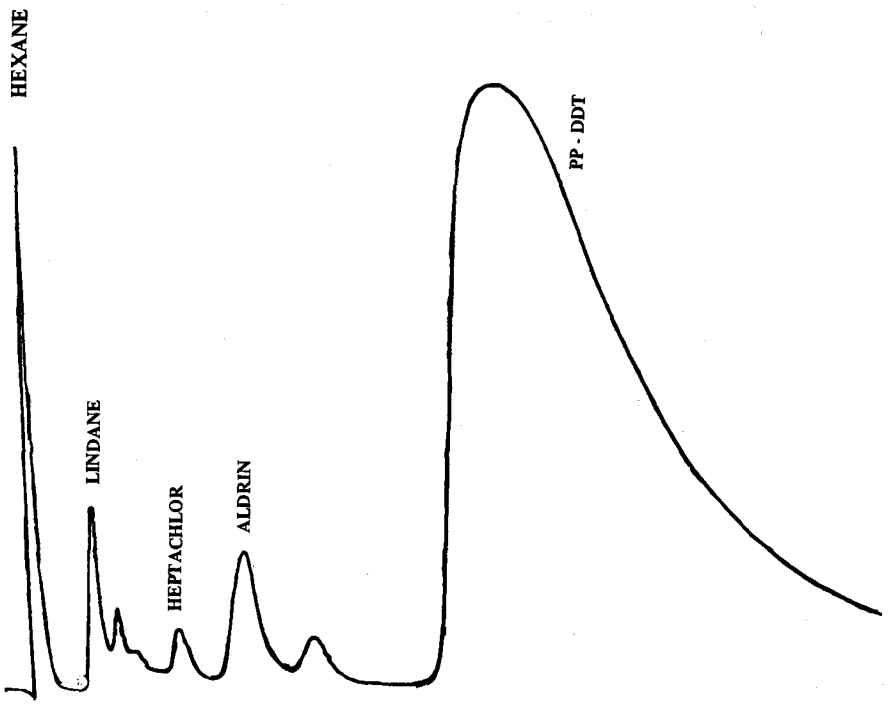

Figure 2

Typical Gas Chromatographic Analysis of Pesticides Extract

The retention times of the pesticides residues on the two columns were compared with those of pure authentic samples secured from the EPA Laboratory, Research Triangle, North Carolina. Quantitative and qualitative determination of the major pesticides residues were made for the ten water samples. Results are shown in Table 2.

TABLE 2

Pesticides Residues Concentrations in Northern Mississippi Water (Nanogram/liter)

Sample Number	Aldrin	Heptachlor	Lindane	PP-DDT
1	0.07	0.03	0.04	7.13
2	0.49	0.18	0.09	8.91
3	0.35	0.08	0.11	12.12
4	0.18	0.06	0.12	7.13
5	0.12	0.04	0.06	4.58
6	0.33	0.12	0.16	12.31
7	0.03	0.07	0.10	3.14
8	0.43	0.15	0.02	7.77
9	0.07	0.04	0.02	4.50
10	0.01	----	0.05	2.73

Table 2 indicates that PP-DDT and Aldrin are present in fairly high concentrations especially in L. Tallahatchie and Yazoo Rivers. Further study of the aquatic, plants and fish in these rivers is in progress.

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