Detection and Determination of Chlorinated Pesticide Residues in Raw and Various Stages of Processed Vegetable Oil

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ABSTRACT

One hundred and ten samples of raw oil and the oil of various stages of processing, i.e., neutralized, hydrogenated, decolorized, deodorized, and shortenings were taken from seven operating oil processing factories of Iran. The samples were analysed by gas chromatography for detection and determination of chlorinated pesticide residues. The results show the presence of DDT and its metabolites as well as lindane, dieldrin, and endrin in raw and processed oil, and their relative loss is due to chemical and heat treatment.

INTRODUCTION

Nearly 80% of raw vegetable oils used in shortening factories in Iran are imported from the U.S.A. and U.S.S.R. Oilseed fields in Iran are extensively sprayed with various chlorinated pesticides. The purpose of this study has been to detect and determine the chlorinated pesticide residue levels in shortenings as consumed by the public as well as to investigate the effect of processing on the concentration of pesticide residues.

The samples were taken from various batches of the same original raw oil undergoing various stages of processing.

MATERIALS AND METHODS

The samples were taken from seven operating factories from April 1974 to July 1974, chilled immediately, and brought as such to the laboratory within 2 hr. The analyses began on receiving the samples. The AOAC method (1) was used. The 6% and 15% elutions of diethylether in petroleum ether containing the residues were injected into the Varian aerograph Model 1400 equipped with Ni^{63} electron capture detector. A 6 ft x 2 mm DO glass column packed with 5% DC-200 on 60/80 mesh chromosorb was used. The peaks were validated by using another column of similar dimensions packed with 10% OV-1 on 100/120 mesh VARAPORT 30.

Operating conditions were 190 C for column, 220 C for injector, and 240 C for detector; carrier gas (N_2); flow rate 40 ml/min. With 5 μl sample size and 0.5 cm/min recorder speed, sensitivity was 0.001 ppm.

RESULTS AND DISCUSSION

The levels of chlorinated pesticide residue calculated from chromatograms in samples of raw oil show the presence of mean values of 0.0295 ppm lindane, 0.009 ppm heptachlor, 0.008 ppm DDE, 0.033 ppm TDE, 0.042 ppm DDT, 0.006 ppm dieldrin, and 0.004 ppm endrin.

In the finished product, the mean values correspond to 0.002 ppm lindane, 0.00 (zero) heptachlor, 0.004 ppm DDE, 0.018 ppm TDE, 0.006 ppm DDT, and 0.002 ppm dieldrin. The endrin, though present in 20% of raw oil samples, was not found after stages of processing subsequent to neutralization (Table I). It appears that in the course of processing there is marked diminution of pesti-

TABLE I

Chlorinated Pesticide Residues in Crude Vegetable Oils after Various Stages of Processing[a]

Stages of process	Pesticide residue						
	Lindane	Heptachlor	DDE	TDE	DDT	Dieldrin	Endrin
Raw oil	0.0295	0.009	0.008	0.033	0.042	0.006	0.004
Neutralized oil	0.0135	0.002	0.005	0.009	0.016	0.006	0.005
Hydrogenated oil	0.012	0.00	0.002	0.004	0.014	0.006	0.00
Decolorized oil	0.002	0.00	0.003	0.014	0.014	0.0045	0.00
Deodorized	0.002	0.00	0.007	0.019	0.012	0.004	0.00
Shortenings	0.002	0.00	0.004	0.018	0.006	0.002	0.00

[a] Average parts per million (ppm).

cide probably due to thermal and chemical decomposition (2). Alternatively, it may be explained in the case of DDT through dehydrochlorination of DDT to TDE by heat treatment (3).

In Table II the results of analyses of different stages of processes of native and imported vegetable oil in a factory are presented. The results show the relatively large proportion of contamination of native oil as compared to those of the U.S.S.R.

The solvent extracted raw oils (Table II) show considerable low levels of pesticide residues; the percentages of shortenings contaminated by pesticide residues were 15% by lindane, 20% by DDE, 20% by TDE, and 10% by DDT and 15% dieldrin.

REFERENCES

1. Association of Official Analytical Chemists, "Official Method of Analysis," 11th Edition (1970).
2. Elkins, E.R., R.P. Farrow, and E.S. Kin, J. Agr. Food Chem. 20:286 (1972).
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TABLE II

Pesticide Level after Various Stages of Processing of Different Oilseed in a Typical Factory Using Different Raw Oils[a]

	Various stages																			
	Raw					Neutralized						Hydrogenated				Deodorized				
	Type of oil																			
	Native soybean	Native sunflower	Cottonseed (Native)	U.S.S.R. imported sunflower	U.S. imported soybean	Native soybean	Cottonseed (Native)	U.S. imported soya	Native sunflower	U.S.S.R. imported sunflower	Native sunflower	U.S. imported soya	U.S.S.R. sunflower	Mixed batches	Native soybean	Native sunflower	Cottonseed (Native)	U.S.S.R. imported sunflower	U.S. imported soybean	Mixed batches
Lindane	0.00	0.023	0.012	0.013	0.00	0.00	0.008	0.00	0.023	0.013	0.016	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aldrin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DDE	0.015	0.009	0.009	0.007	0.018	0.015	0.009	0.008	0.00	0.00	0.00	0.001	0.00	0.001	0.00	0.00	0.00	0.00	0.00	0.001
TDE	0.017	0.035	0.036	0.012	0.086	0.017	0.030	0.020	0.001	0.00	0.00	0.001	0.00	0.001	0.00	0.00	0.00	0.00	0.00	0.001
DDT	0.00	0.075	0.033	0.009	0.019	0.00	0.016	0.018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dieldrin	0.014	0.00	0.00	0.00	0.00	0.014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.004
Endrin	0.00	0.026	0.004	0.002	0.008	0.00	0.004	0.00	0.00	0.00	0.006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

[a]Average parts per million (ppm).