

PCB IN RECYCLED PAPER PRODUCTS

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ABSTRACT

PCB mixtures occur in amounts of 5 to 6000 ppb in paper products made of recycled material. Contents in samples made from Central-European raw material were higher than those from Finnish material. However, origin of some samples with high contents remained unknown.

INTRODUCTION

This study was initiated because we observed an intensive smell of PCB in letter envelopes made by a Finnish company from recycled "environmentally friendly" paper for our University. Determination of PCB gave contents of mixture analogous to Aroclor 1242 in a large envelope as high as 4 ppm ($\mu\text{g/g}$). Therefore, various products made from recycled paper were analyzed and the producers asked for origin of their raw material and possible other sources of PCB in production.

SAMPLES AND ANALYSES

The samples studied are listed together with the determination results in Table 1. The samples were cut in small pieces, weighed, 2,4,6-trichlorobiphenyl added as an internal standard, and extracted in Soxhlet with a solvent mixture diethyl ether - acetone - petroleum ether 60-80 - hexane (1:5.5:9:2.5 v/v/v/v) for six hours. The extract was evaporated in Rotavapor and finally with nitrogen gas stream. One ml of hexane was added and the solution shaken three times with 2 ml of conc. sulfuric acid. Then, the solution was transferred to a column of 1 g of neutral alumina (activated in 800°C and deactivated with 5 % of water) in a Pasteur pipette. The column was eluted with 10 ml of hexane and the eluate evaporated to a small volume and 1 μl of it injected to gas chromatograph (MICROMAT HRGC).

Dual column system including quartz capillaries 25 m long and 0.32 mm ID and 0.25 μ m phase thickness was used. The stationary phase in one column was SE-54 and in another OV-1701. EC detectors were used. Carrier gas applied was He 1 ml/min. The temperature program used was 150° - +5°/min - 260°C, and stay there 10 minutes. The quantitation was done by comparing intensities of 12 main peaks to the corresponding peaks of weighed standard of Aroclor 1242 (Fig. 1). Limit of determination was 1 ng/g.

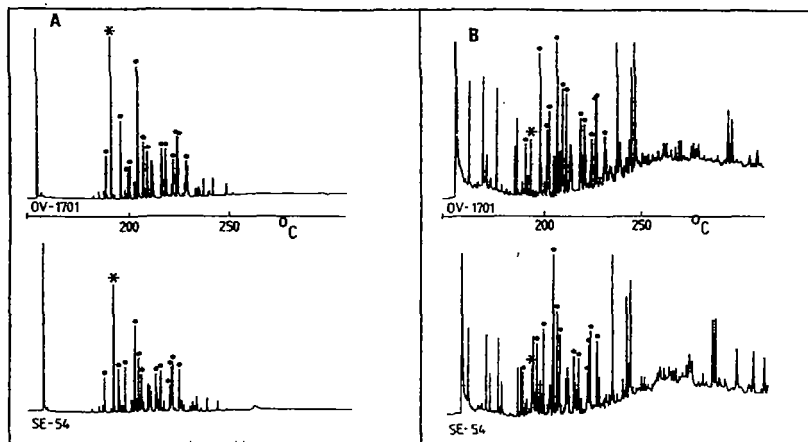


Fig. 1. Gas chromatograms of PCB fractions. The internal standard peak is marked by an asterisk and the peaks taken into quantitation by a dark spot. A. Reference mixture of Aroclor 1242. B. Tissue paper; 25.3 g sample containing 327 ppb of PCB.

TABLE 1. Samples and their contents of PCB as Aroclor 1242.

Sample	Origin of raw material	PCB ng/g (ppb)
Letter envelope	Federal Republic of Germany	4093
"	"	1489
"	"	1129
"	"	80
"	"	388
"	"	433
Small envelope	Finland	30
Toilet paper	Federal Republic of Germany	359
"	"	466
"	"	5
"	Austria	127
"	Finland	25
"	"	23
"	"	41
"	"	74
Tissue paper	Finland	327
"	"	22
Cardboard box	outer surface	Unknown origin
"	central layer	"
"	inner surface	"
		6345
		1010
		4787

DISCUSSION

Paper products have been shown to contain 10-100 pg/g amounts of chloro-aromatic ethers, such as PCDDs and PCDFs.¹⁻³ Origin of these compounds was first assumed to be chlorobleaching of pulp. However, other sources play a significant role, as was seen in the elevated concentrations of some PCDDs and PCDFs in recycled paper.¹ Also other chloroaromatics from pulp bleaching, like R-PCDFs and UPACs appear in papers.^{3,4} Present analyses show that PCBs can occur in recycled paper products at levels which are several orders of magnitude higher than those of PCDDs and PCDFs. Because some PCB components are similarly toxic as 2,3,7,8-chlorosubstituted PCDDs and PCDFs, our observation calls for further control analyses of recycled papers. In addition, other EC-active persistent (H_2SO_4 -resistant) compounds appear in these samples (Fig. 1) requiring more consideration.

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