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SUBJECT: TOXICITY OF POLYCHLORINATED DIBENZOFURANS

REFERENCE

TO : C. C. Sisler
R2E

A literature search was made on the toxicity of polychlorinated dibenzofurans (PCDF). The literature, although sparse, does indicate that polychlorodibenzofurans are toxic. They are more toxic than are polychlorinated biphenyls but are approximately ten times less toxic than tetrachlorodibenzo-p-dioxin (TCDD). Data on the lethality of TCDD¹⁴ reveal that a single oral LD₅₀ ranges from 0.0006 mg/kg in male guinea pigs to 0.115 mg/kg in rabbits of mixed sex. Based on the available literature, the order of PCDF toxicity has been estimated to be:

Dichloro=Tetrachloro>Trichloro>Octachlorodibenzofuran.

The toxic effects reported include: (1) skin irritation (chloroacne) to humans¹¹ and rabbits^{8,9}; (2) lesions resembling those produced by chick edema⁹; (3) edema formation in rabbits⁸; (4) liver damage in rabbits^{5,8}; (5) death in chick embryos^{2,3}; and (6) death to salmon¹.

A number of references indicate that PCDF are more toxic than polychlorobiphenyls (PCB) and are responsible for some of the toxic effects attributed to PCB^{3,4,6,7}. Vos² conducted a chick embryo assay and found that a chromatographic fraction from two polychlorinated biphenyl preparations (Phenoclor DP6 and Clophen A6) containing tetrachloro, pentachloro, hexachloro and heptachlorodibenzofuran were highly toxic. A corresponding fraction from Aroclor 1260 which did not contain those compounds did not have a significant toxic effect on the chick embryo. Bowes³ also attributed laboratory embryonic deaths to the chlorinated dibenzofurans in PCB.

Zitko¹ reported a median mortality rate of 120 days for juvenile Atlantic salmon which were fed dry fish food containing:

Dichlorodibenzofuran - 2.7 µgm/gm

Trichlorodibenzofuran - 5.7 µgm/gm

Tetrachlorodibenzofuran - 2.8 µgm/gm

Octachlorodibenzofuran - 9.1 µgm/gm

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These data indicate the order of toxicity to be:

Dichloro=Tetrachloro>Trichloro>Octachlorodibenzofuran.

In contrast, a single dose of 2,8-dichlorodibenzofuran (122 mg/kg) administered to brook trout caused no fatalities¹².

Liver necrosis resulted following a single oral dose (0.5-1.0 mg/kg) of tri and tetrachlorodibenzofuran in rabbits. In comparison, a dose of

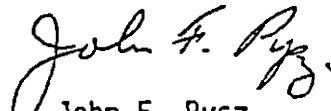
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0.05-0.1 mg/kg of 2,3,7,8-tetrachlorodibenzo-p-dioxin produced liver necrosis and chloracne⁵. These data indicate that PCDD is perhaps 10 times more toxic than PCDF. The PCDF's were also found to be acne-inducing agents^{8,10}.

It is believed that toxicological studies on PCDF's are now in progress or will be in the near future by the Federal Drug Administration. There is also an indication that some toxicity studies on PCDF's have already been made. The source of the study, however, has not been clearly defined.

The sources used for this literature search were chemical abstracts and a bibliography in Environmental Health Perspectives, 1973, (5), pp 283-312.


John F. Pysz

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