

POLYCHLORINATED BIPHENYLS (PCB'S)

by

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The term PCB is new for most of the people in the poultry industry. However, PCB's have been studied since 1881 and have been in extremely wide industrial use since 1930. The chemical properties which make PCB's desirable industrial materials are their excellent thermal stability, strong resistance to both acidic and base conditions, their resistance to oxidation and their general inertness which makes them very stable, or inactive, compounds.

The most important physical properties of the PCB's are: low vapor pressure (they have very high boiling points); low water solubility; a high dielectric constant (they will not conduct electricity except under extreme conditions).

The largest single use of PCB's is related to their electrical properties -- as coolant-insulation fluids in transformers. They are used in ballasts for fluorescent fixtures and plasticizers in electric wire and cables. Due to their thermal properties and fire resistance they are used in high pressure hydraulic fluids, specialized lubricants, gasket sealers, and machine tool cutting oils. Other miscellaneous uses include: binders in epoxy paints, toughening agents in varnishes and waxes, adhesives, and carbonless paper. The PCB property which has brought about the current situation in the poultry industry is its heat transfer usage. The USDA statement indicates that a shipment of Peruvian fish meal was being heat treated. The fluid PCB's were being used as heat transfer materials when a leak developed in the heating chamber, which resulted in a contamination of the fish meal. Unknowningly, the fish meal containing PCB's moved into the feed trade. Various quantities of this meal have been located in 12 southeastern states. The source plant where this accident occurred has been closed and all existing fish meal has been seized.

McCune and Associates (1962) reported that PCB's were moderately toxic when fed at a level of 0.02% and caused high mortality and extensive pathology within 4 weeks at a dietary level of 0.04%. Gross pathology included hydropericardium, hydroperitoneum, enlarged heart, liver and kidneys, and hemorrhage of internal organs. Microscopically the kidneys showed marked tubular dilatation and numerous casts.

Rohfeld and Associates (1971) reported the maximum tolerance of PCB's containing 48% chlorine in the chick is approximately 50 ppm. Symptoms observed in the chick fed PCB's included depressed weight gain, edema, gasping for breath, hyperpericardial fluid, internal hemorrhaging, depression of secondary sexual characteristics and an increase in liver as percentage of body

weight. Several of these symptoms were present when levels of more than 20 ppm of PCB's were fed.

Trout are sensitive to PCB's, however, dosages must be more than 500 times higher than DDT to have the same results. Observations by Shutze and Charles, (1971) under field conditions indicate that hatchability is markedly depressed when PCB concentration in the egg exceeds 2 ppm. One commercial flock of light breeders attained approximately 20% hatchability when the eggs contained 1.6 ppm. Another flock 85% hatchability was attained when the eggs contained 1.2 ppm and body fat of the hens was 12 ppm. There appears to be an approximate ratio of 10:1 between the concentration of PCB's in the hen body fat and the egg. When the fertile eggs contain approximately 2.5 ppm, hatchability will be less than 0.5%. Approximately 20%-30% of the chicks pip but are unable to emerge from the shell. A few embryos die all through the incubation period but the majority die during the latter part. The livers of the dead embryos appear slightly swollen and blotchy in appearance and an occasional lesion may be present. Also in some embryos an accumulation of fluid may be seen in the pericardium.

Feed consumption, egg production and livability appears to be normal in all mature and growing flocks of chickens and turkeys. Fertility has not been depressed in any of the flocks being monitored.

Hydrocarbons such as PCB's, chlordane, dieldrin and DDT have been shown to activate enzymes in the liver which transform estrogen and other compounds (DDT, dieldrin and certain drugs) into a more water-soluble form that is readily eliminated from the body. Estrogen is involved in calcium metabolism and the presence of hydrocarbons in tissues has been suggested as the reason for soft shelled eggs among some wild birds.

PCB's have received little attention in biological research because of their excellent safety record in wide usage. When routine pesticide analyses are made using gas-liquid chromatography, a standard laboratory procedure, PCB's will show up on the chromatogram similar to dieldrin, DDT, DDE, Aldrin and heptachlor oxide. Most laboratories now utilize procedures which separate the pesticides and PCB's.

In tests conducted at the University of Cincinnati, Aroclor vapor (Monsanto trade name for PCB's) toxicity studies on guinea pigs, mice, rabbits, and rats showed no severe effects after 24-day exposure to 0.83 parts per million (ppm) for seven hours per day on 17 of those days. Even after more prolonged tests there were no severe effects from the Aroclor 1242. In the second study, three groups of beagles were fed Aroclor 1242, 1254, and 1260 respectively at a rate of 100 ppm in their diets. After three months no significant abnormalities were noted.

Based on the chemical and physical properties of PCB's and on their extremely wide occurrence and over 40 years of usage, it is difficult to believe that there is any danger to the consumer. However, all products are being carefully monitored to insure that there will be less than 5 ppm PCB's in poultry meat and 0.5 ppm in eggs being used for human consumption. Close cooperation between the State Poultry Federation, the USDA Consumer Protection Agency,

FDA, associated poultry and egg industries, and the Cooperative Extension Service will further insure the marketing of wholesome products and the alleviation of the current problem.

Poultrymen who suspect PCB contamination should submit samples of these materials to a reputable laboratory for analysis. Since limited laboratory facilities are available one should check with his ingredient suppliers to avoid test duplication of relatively expensive analysis. All feed and ingredient handlers should follow the standard recommended feed quality control practice of maintaining samples of all ingredients and finished feeds for future reference. A list of laboratories with PCB determination capabilities is available from the Department of Extension Poultry Science, University of Georgia, or U. S. Department of Agriculture, Washington, D. C. Methodology for the performance of PCB analysis can be obtained from Mr. Paul Elliott, Chief, Chem. & Microb. Br. Lab. Services Div., Room 604, C&MS USDA, Washington, D. C. 20250. Telephone No. 202-388-4212.

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