# A Study of the Rate of Absorption of Methylated Mercury by *Carassius auratus*

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*Abstract*

Radioactive tracer techniques were used in determination of the rate of absorption of a methyl mercury compound by goldfish. Goldfish were retained for specified times in test concentrations of $CH_3HgCl$ containing commercially-prepared $\gamma$-active $Hg^{203}$. It was found that the fish concentrated the mercury by a factor of $2 \times 10^2$ in the 36-48 hours required for saturation.

## Introduction

The problem of mercury poisoning has recently been one of intense interest in the United States and other countries (1, 2). The degree of contamination, the biological effects, the allowable safe amounts in our waters, the methods of contamination, and many other questions pertaining to mercury and its compounds remain, at best, only partially answered. This paper is primarily concerned with the rate at which a particular mercury compound is absorbed by goldfish at various concentrations.

Monomethyl mercury was used because of its solubility in water and because it is the generally accepted compound produced by anaerobic bacteria in river and lake bottoms (4).

## Measurement

Known concentrations of the $CH_3HgCl$ with $\gamma$-active $Hg^{203}$ was used as a radioisotope tracer. This isotope was chosen because the $\gamma$-emitted could be easily detected without destroying the fish. To keep the fish alive during the time required to measure the $\gamma$-activity (a few minutes), the fish were placed in a container of fresh running water.

The detector arrangement was calibrated and adjusted using a pulse height analyzer. The initial adjustments were made with gamma rays from a $Cs^{137}$ source to obtain a suitable energy calibration. The intensity calibration was accomplished using a known quantity of $Cs^{137}$ and $Na^{22}$ and a scaler counter. Several different levels of contamination were investigated. These were 5 ppb, 50 ppb and 500 ppb. Six fish were placed in each container.

## Results

The curves shown in Figure 1 is of the form $C = C_M(1-e^{-\lambda t})$, where C is the concentration, $C_M$ is the maximum concentration achieved and $\lambda$ is a factor related to the rate of absorption. For the 5 ppb sample

$C_M = 0.73$ ppm and $\lambda = 0.96$ hr$^{-1}$ and for the 50 ppb sample $C_M = 6.9$ ppm and $\lambda = 0.108$ hr$^{-1}$. With these fits, one half of the final concentration is reached in only 7.2 hours and 6.4 hours for the 5 ppb and 50 ppb concentrations, respectively. In addition to the absorption rate found, it was discovered that on two different occasions a concentration of 500 ppb produced 100% fatality in that particular group of fish within 24 hours.

A study of the rate of de-absorption was also attempted but was not completed. The reason we did not complete this study was that our $Hg^{203}$ with a 47-day half-life decayed so rapidly that meaningful numbers could not be obtained. A reasonable assumption for the biological half-life in fish is 500 days during normal activity (3). The only conclusion we could draw was that the rate of de-absorption was much greater than the rate of decay of $Hg^{203}$.

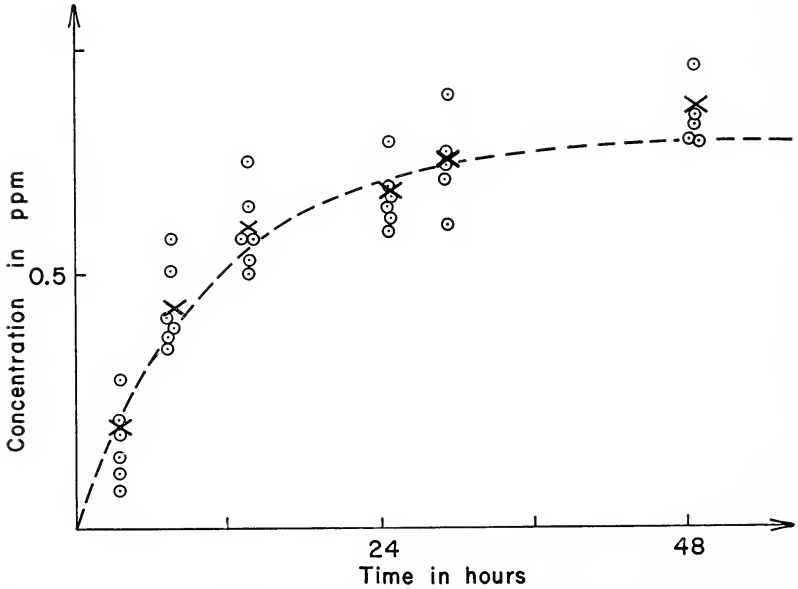


FIGURE. 1. *Result for aquatic concentration of 5 ppb. (⊙ represents the concentration in the individual fiish; X represents the fish weight averaged concentration.)*

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