Trends of some organochlorine residues in prawn (*Macrobrachium Nipponense)* from Kasumigaura Lake during 1970s - 1990s

Sunardi [a)], S. Masunaga [a)], N. Iseki [c)], S. Kasuga [c)], J. Nakanishi [a,b)]

[a)] Yokohama National University; [b)] Research Center for Chemical Risk Management, AIST; [c)] National Institute for Environ. Studies

1970 から 1990 年代の霞ヶ浦のエビにおける有機塩素系化合物汚染の変遷

Sunardi、 益永茂樹、中西準子（横国大･環情院）、春日清一、井関直政（国環研）

Introduction The studies on the Kasumigaura Lake, generally concern the ecosystem of the area surrounding the lake, the variation of biomass[1,2], the density and production of biomass[3] and the characteristics of biomass[4]. However researches concerning the pesticide residues in organisms due to previous application in the surrounding area are rare. The aim of this study is to find the HCH, HCB and DDT residues concentration accumulated in the fresh water prawn, to understand the environmental concentration.

Materials and Methods The prawn samples *(Macrobrachium Nipponense)* were trawled from Kasumigaura Lake as shown in Fig 1, in July and October, 1978 – 1993. Powdered prawn samples were extracted by Soxhlet apparatus for 15 hours with dichloromethane. Fat content was measured by gravimetric method. Five ^{13}C-labelled DDTs were spiked to the samples before being subjected to sulfuric acid treatment and a sequence of silica gel, alumina and silica gel impregnated carbon column separations. Identification and quantification were performed using GC-MSD.

Results and Discussions Among the HCH isomers, only β-HCH was detected in all samples. This is probably due to the banning of HCH and lindane since 1971. β-HCH concentration decreased from 42 ng/g fat in 1978 to 7.44 ng/g fat in 1993. p,p'-DDE was the only DDT isomers detected in the samples. The metabolism of DDT under an aerobic condition in biota body may be the reason for this greater p,p'-DDE concentration[5]. p,p'-DDE concentration decreased from 97.95 to less than 2.5 ng/g fat, indicating that fresh DDT is not used anymore. The concentrations of HCB were in the range of 1.64 to 0.29 ng/g fat. They were below the levels of Venice lagoon mussel and clam[6] and also lower than the fish samples collected from inland and coastal waters of Cambodia[7]. The low HCB concentration found in Kasumigaura Lake was probably due to the no experience of HCB use as agrochemicals in the basin as well as restriction on use of PCNB, TCTP and PCP that contained HCB as impurities. The time trend decreases of β-HCH, HCB and p,p'-DDE concentration in the prawns could be approximated by exponential equation. In order to simulate these time trends, following model calculation was performed assuming that pesticide in the agricultural field will decrease exponentially due to biodegradation and run-off

$$Q_i = C_i + Q_{(i-1)}\exp(-0.693/T_{1/2})$$

Q_i: Amount of pesticide in the catchment area in the year i.

C_i: Amount of pesticide sprayed in the year i.

$T_{1/2}$: Half-life of pesticide in the catchment area soil (year).

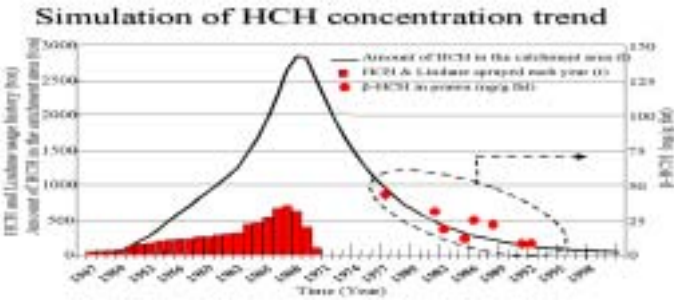
The amount of pesticide sprayed in the area each year (C_i) was estimated based on the statistic of agrochemical use and trend of Q_i was plotted in Fig. 2 assuming for example $T_{1/2}$ was 5 years[8,9]. Simulated results of β-HCH and p,p'-DDE in the catchment area were in accordance with the trends of these chemicals in prawns. This can be justified if time trends of pesticide concentration in the lake water were directly related to the amount of pesticide run-off.

Fig 1. Sampling location (left)

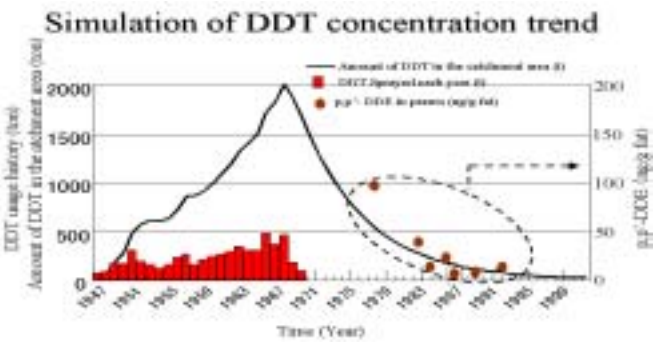
Fig 2. Correlation between load and detected concentration

(a) HCH and β-HCH

(b) DDT and p,p'-DDE



(a)



(b)

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