ANALYSIS OF OCPs USING HRGC-HRMS AND THEIR CONTAMINATION PROFILE IN ASIAN DUST

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Introduction

Asian dust comes from the very dry areas of the Taklamakan and the Gobi Desert in the northwest region of China and Mongolia. The dry and frozen ground during the winter melts in the spring, breaks down into small pieces, finally becomes dust(20μm or below), and is blow by winds. As the dust goes up in atmosphere, it rides on the prevailing westerlies to travel eastward to Korea.. It can carry various substances from the areas of origin. POPs are semi-volatile, a property which permits these compounds either to vaporize or to be adsorbed on atmospheric particles. They therefore undergo long range transport in air and water from warmer to colder regions of the world. The air could have endocrine disruptors (Eds), so called environmental hormone, and persistent organic pollutants (POPs). These substances could have bad effects on the human body and even have fatal effects on the development and immunity of the next generation. OCPs among POPs had been banned or unregistrated until the early 1980s. Purpose of this study is to elucidate the accumulation and behavior of persistent organic pollutants (POPs), such as DDTs and Drins, in arable lands in East Asia, especially in China and Korea.

Materials and Methods

OCPs detection patterns of Asian dust collected in Chinese(n=2) and Korean(n=4) sites were estimated by using HRGC/HRMS based on ^{13}C-labeled standards(17 compounds) of organochlorine pesticides (OCPs). The amounts of use of organochlorine pesticides (Aldrin, Chlordane, DDTs, Dieldrin, Endrin Heptachlor, HCHs and Toxaphene) from 1958 in Korea were estimated based on *Agrochemical Year Book* (Edited by Korea Crop Protection Association). In April 2007, Asian dust was collected by the active sampler in Korea and China. The sample 3g was extracted with soxhlet using acetone for 16 hours. All the extracted solvents were rotary evaporated to 10ml and then 5ml among 10ml extracted solution were used for cleanup using florisil column. Quantification and identification of OCPs were performed with the Finnigan mat. 95XL HRGC-HRMS system fixed EMV-8MS (30m×0.25ml×0.25㎛). The HRGC-HRMS program for OCPs had a resolution of more than 10,000 with selected ion monitoring(SIM). The native(22 compounds) and ^{13}C-labeled standards(17 compounds) of organochlorine pesticides (OCPs) were used for preliminary calibration purpose. All these standard mixture were analyzed in HRGC-HRMS. Relative response factor (RRF) was performed using five different native standard dilutions.

Results and Discussion

The amounts of use (active ingredient basis) of organochlorine pesticides from 1958 in Korea were from 8 to 748 t (fig.1). OCPs were banned from the end of 1960s to the early 1980s. The concentration of OCPs in Korean arable land were showed as decreasing order as follows : orchard > upland > paddy(2006, Choi). Predominant compounds were DDT and its metabolites to the total OCPs(fig. 2). Asian dust deposit about 44.0 kg ha^{-1} yr^{-1} in Korea. Monthly distribution of Asian dust was observed as 86.4% from March to May in Korea during 1965~2007. Predominant soil property of Asian dust collected in Korea and China was illite(Fig. 4). Sampling sites in April 2007 showed a similar analytical results that was *beta*-HCHs as predominant OCP. However, *beta*-HCHs nearly was not to be found in Korean arable land. That reason was because of a low vapor pressure and condensing temperature on HCHs . On the other hand, DDT and its metabolites were dominant OCPs in Asian dust as well as arable land (fig. 6). As a result of this analysis, arable land was possible to pollute OCPs by Asian dust , especially DDT and its metabolites.

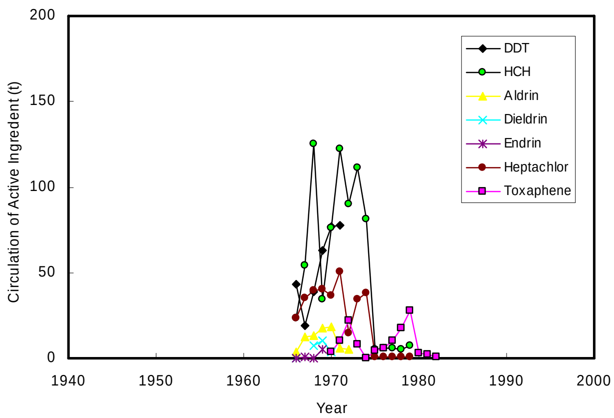

Fig.1. Temporal trend of the amounts of use (active ingredient base) of organochlorine pesticides in Korea

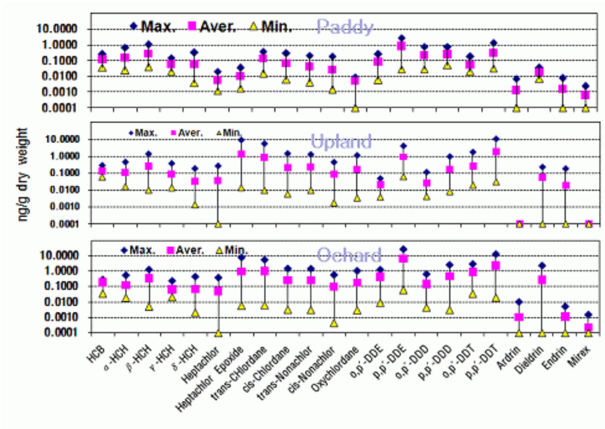

Fig. 2. Comparative concentration range of OCPs in cultural soils (a) paddy soils, b) upland soils, c) orchard soils) in Korea.

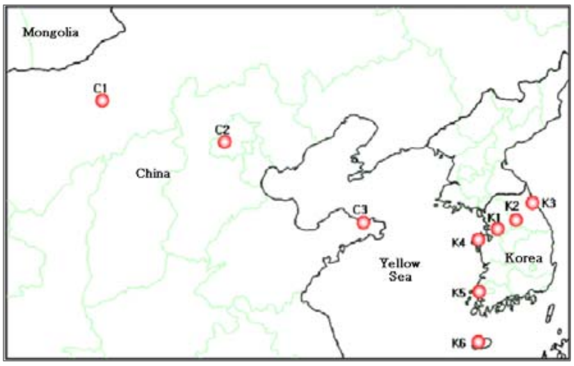

Fig. 3. Sites of Asian dust sampling in Korea and

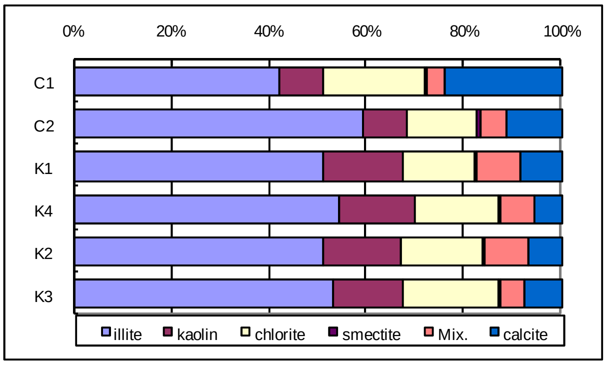

Fig. 4. Composition of Asian dust collected in Korea and China

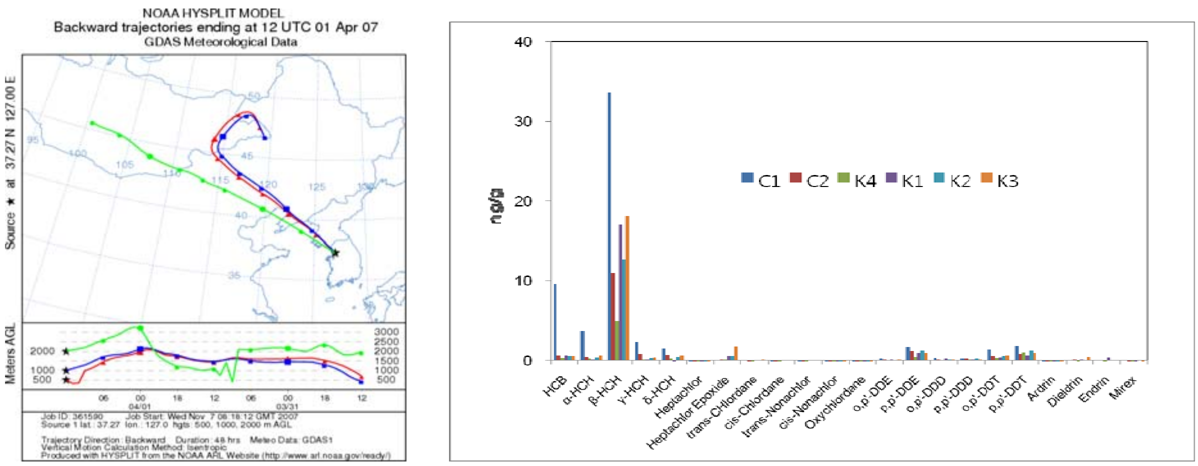

Fig. 5. GDAS meteorological data and OCPs levels of Asian dust collected in Korea and China in 2007

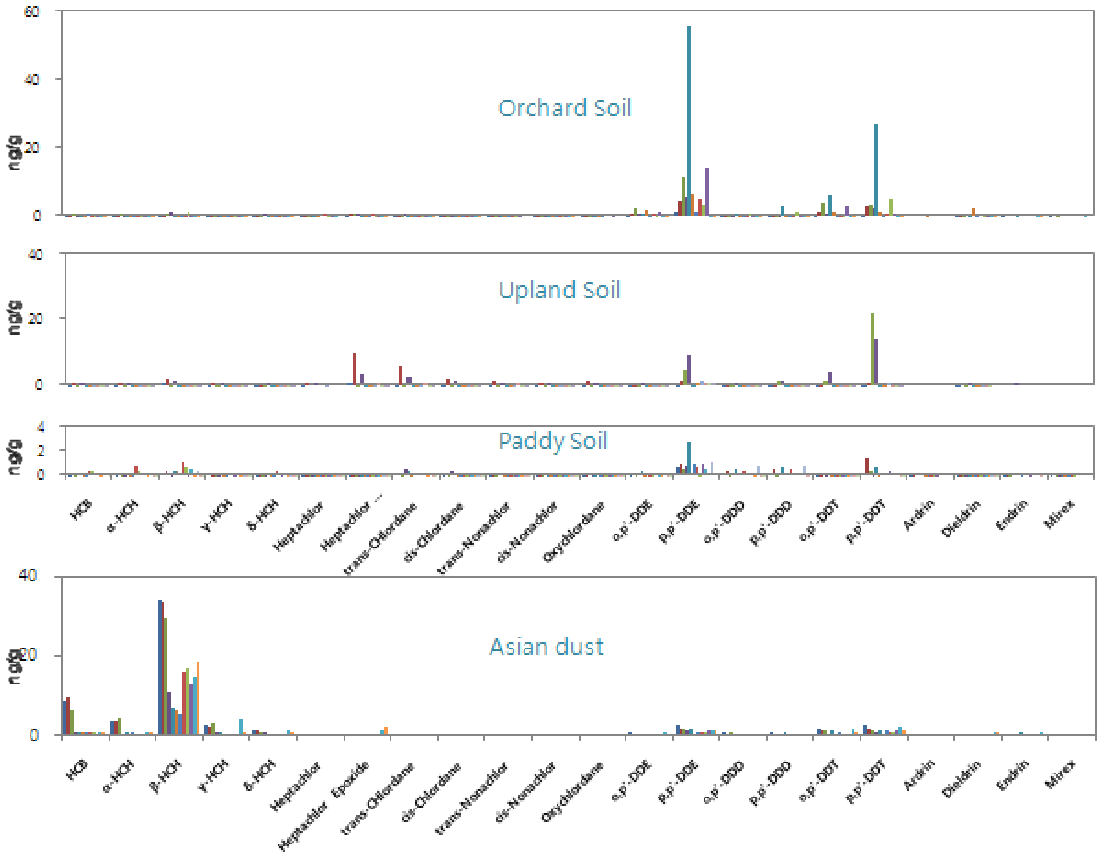

Fig. 6. Comparative contamination profiles of OCPs of Korean arable land and Asian dust collected in Korea and China

References

1. Choi, D.S., Kwon, O.K., Hong, S.M., Kwon, H.Y., 2006, Analysis of POPs using HRGC-HRMS in cultural soils of Korea, . Organohalogen Compounds
2. Eun, H., Kim, Y.S., Cho H.S., Katase, T., 2007, Persistent OrganicPollutants (POPs) in sediment core of Gwangyang Bay, South Korea. Organohalogen Compounds 69, 1614-1617.
3. N. Seike, H. Eun, T. Otani, T. Choi and S. Hong , 2005, Abstract of the annual meeting, Jpn. Soc. Environ. Chem., 414-415
4. Senthil Kumer K, Watanabe K, Takemori H, Iseki N, Masunaga S, Takasuga T, 2005, Analysis of UNEP Priority POPs Using HRGC-HRMS and Their Contamination Profiles in Livers and Eggs of Great Cormorants (*Phalacrocorax carvo*) from Japan, *Environ. Contam. Toxicol.* 48, 538-551