TPM11 - Session 4

PRA5. Chemical Risk and Management
- Progress of Chemical Risk Assessment in China

Chinese Research Academy of Environmental Sciences

Progress of Chemical Risk Assessment in China

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State Key Laboratory of Environmental Criteria and Risk Assessment

State Environmental Protection Key Laboratory of Ecological Effects and Risk Assessment of Chemicals

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Backgrounds

The development of chemical industry has been beneficial to the economy and the society by meeting the increasing demands in materials, but it has also generated increasingly serious health and environmental safety problems. With China's rapid economic growth, chemical-related environmental issues has garnered increased attention from the government and the society. Technologies and relevant contents of chemical risk assessment and co-operation in the future were introduced in this presentation.

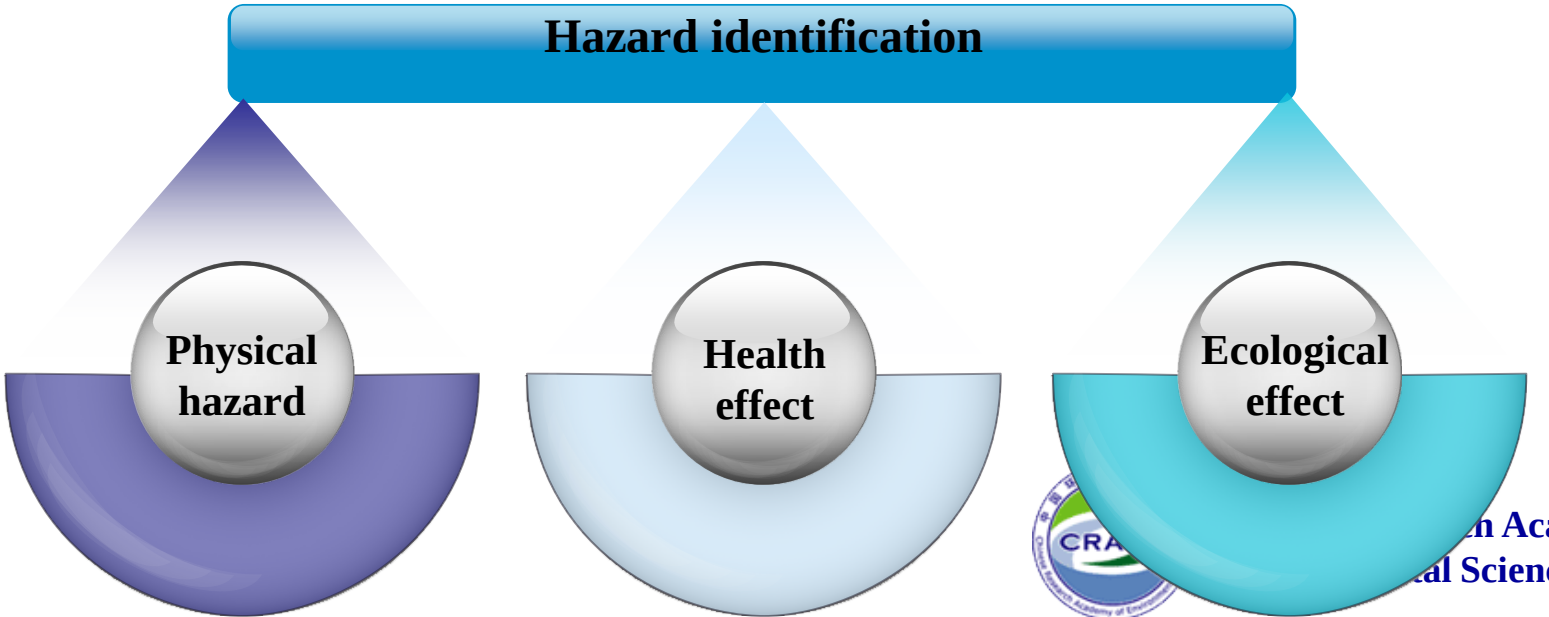
Regulations	Effective date
Provisions on the First Import of Chemicals and the Import and Export of Toxic Chemicals	1994 (Revised in 2007)
Measures on Environmental Management of New Chemical Substances	2003 (Revised in 2010 based on risk management)

Chemicals Risk Assessment in China

1. Hazard identification

There are 11, 10 and 4 indicators for checking the physical hazard, health effect and ecological effect in China, respectively.

Hazard classification	Number of indicators	Guidelines
physical hazard	11	GB 30000.2-GB 30000.17
health effect	10	GB 30000.18-GB 30000.27
ecological effect	4	GB 30000.28……



Chemicals Risk Assessment in China

2. Effect assessment (Dose-effect assessment)

There are 7 extrapolation methods and different assessment factors (AF) of effect assessment for various environmental medias (such as: freshwater, saltwater, sediment, etc.).

Environmental medias	Number of factors	Range of AFs
freshwater	4	10~1000
saltwater	7	10~10000
microorganisms in wastewater treatment plant	6	1~100
freshwater sediment	3	10~100
saltwater sediment	7	10~10000
terrestrial	4	10~1000
secondary poisoning	5	30~3000

Chemicals Risk Assessment in China

3. Exposure assessment

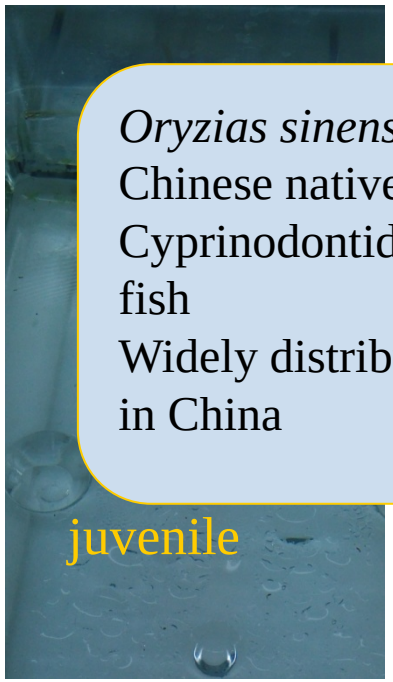
PEC_{local} (predicted environmental concentration) of chemicals in various environmental medias (such as: freshwater, saltwater, soil, etc.) were estimated using exposure modelings.

Environmental medias	Number of factors
freshwater	$PEClocal_{water} = Clocal_{water} = \frac{Clocal_{eff}}{(1+Kp_{susp}\cdot SUSP_{water}\cdot 10^{-6})\cdot DILUTION}$ .....
saltwater	$Clocal_{seawater} = \frac{Clocal_{eff}}{(1+Kp_{susp}\cdot SUSP_{water}\cdot 10^{-6})\cdot DILUTION}$ .....
wastewater treatment plant	$Clocal_{eff} = Clocal_{\inf}\cdot Fstp_{water}$ .....
freshwater sediment	$PEClocal_{sed} = \frac{K_{susp-water}}{RHO_{susp}}\cdot PEClocal_{water}\cdot 1000$ .....
saltwater sediment	$PEClocal_{sed} = \frac{K_{susp-water}}{RHO_{susp}}\cdot PEClocal_{seawater}\cdot 1000$ .....
terrestrial	$PEClocal_{soil} = Clocal_{soil0} + PECregional_{natrualsoil}$ .....
secondary poisoning	$PECoral_{predater} = PEC_{water}\cdot BCF_{fish}\cdot BMF$ .....
underground water	$PEClocal_{grw} = PEClocal_{agr.soil.porew}$ .....

Chemicals Risk Assessment in China

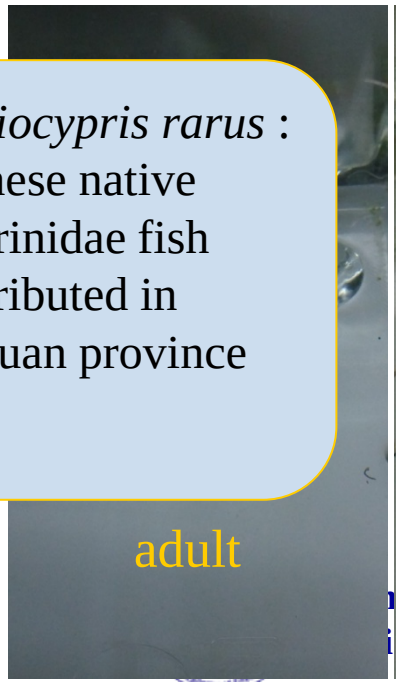
4. Toxicity test - native species

International standard testing organisms (Zebra fish (*Danio rerio*), etc.) are broadly used in ecotoxicology test of chemicals in China. However, these standard testing organisms are not existed in the aquatic environment in China. Recently, some Chinese native species (Chinese medaka (*Oryzias sinensis*), Rare gudgeon (*Gobiocypris rarus*) were bred and were used in toxicity test of chemicals.



Oryzias sinensis:
Chinese native Cyprinodontidae fish
Widely distributed in China

Gobiocypris rarus :
Chinese native Cyprinidae fish
Distributed in Sichuan province



Chemicals Risk Assessment in China

5. Application in environmental criteria

China has recently commenced environmental criteria research. The extrapolation methods of calculating PNEC values could be used to derive water quality criteria, soil environmental criteria, and so on.

Environmental medias	methods
aquatic life criteria	SSD (US-SSD, log-logistic, log-normal, etc.), AF
sediment environmental criteria	SSD (log-logistic, log-normal, etc.), AF, Equilibrium partitioning
soil environmental criteria	SSD (log-logistic, log-normal, etc.), AF, Equilibrium partitioning, Geomean method
air environmental criteria	SSD (log-logistic, log-normal, etc.), AF

Chemicals Risk Assessment in China

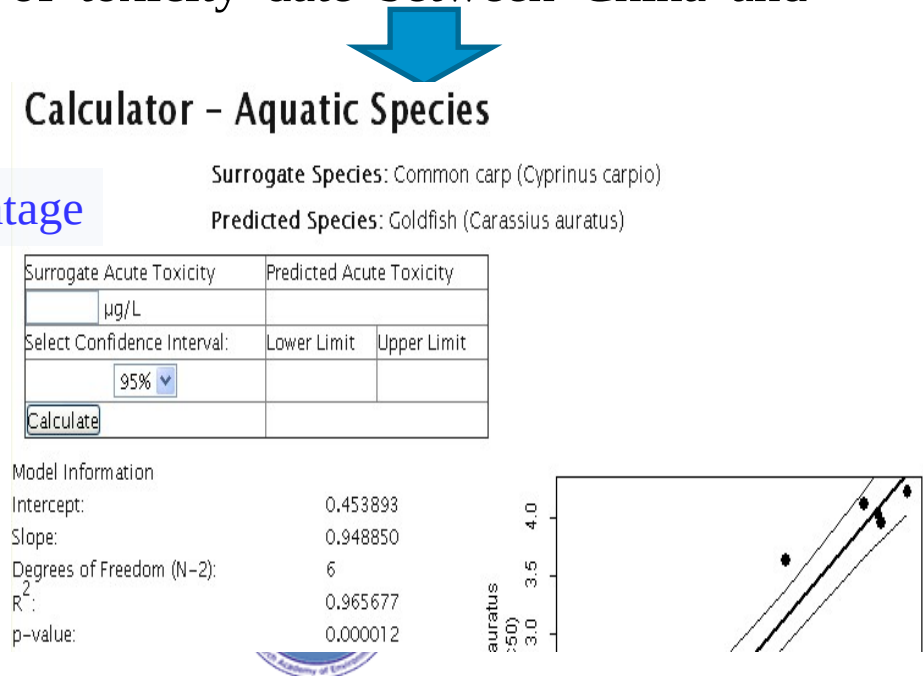
6. Estimation of toxicity – ICE, BER

ICE (interspecies correlation estimation) method established by USEPA could be used to estimate the toxicity of chemicals to organisms. Recently, we preliminarily developed an ICE method using toxicity data of Chinese native species, and it was proved to be feasible.

BER (biological effect ratio) method could be used to preliminarily estimate PNEC values based on the differences of toxicity date between China and another country.

advantage

1. make fully use of the existing toxicity data
2. provide sufficient toxicity data to derive PNEC



Chemicals Risk Assessment in China

7. GLP laboratory establishment

State Environmental Protection Key Laboratory of Ecological Effects and Risk Assessment of Chemicals is a GLP laboratory authorized by MEP (Ministry of Environmental protection), and testing of chemicals could be carried out, such as:

Fish acute/chronic toxicity test	Daphnia acute immobilization	Ready biodegradability	Terrestrial plants growth test	Earthworm acute /chronic toxicity test





Co-operation: Current state

Exchange, workshop, technology training of CRA

Exchanges, workshops and technology trainings of chemical risk assessment with USEPA, RIVM, OECD, environmental research center of Lancaster university, etc., were held annually in recent years.

The International Workshop on CRA

International Technology Training of CRA

Sino-America Workshop on CRA

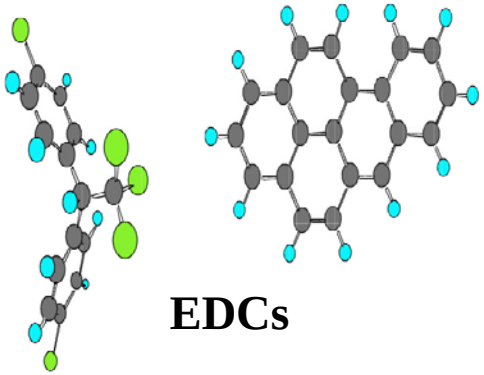
Exchanges with OECD, Lancaster University, etc.

Co-operation: Suggestion

1. Effective method for rapid assessment of emerging chemicals

With the rapid economic growth, emerging pollutants (PCPs (personal care products), EDCs (Endocrine Disrupting Chemicals), etc.) have garnered increased attention from the government and the society in China. Therefore, effective method for rapid assessment will be helpful to due with the problem generated by emerging chemicals.

rapid assessment method



EDCs

PCPs

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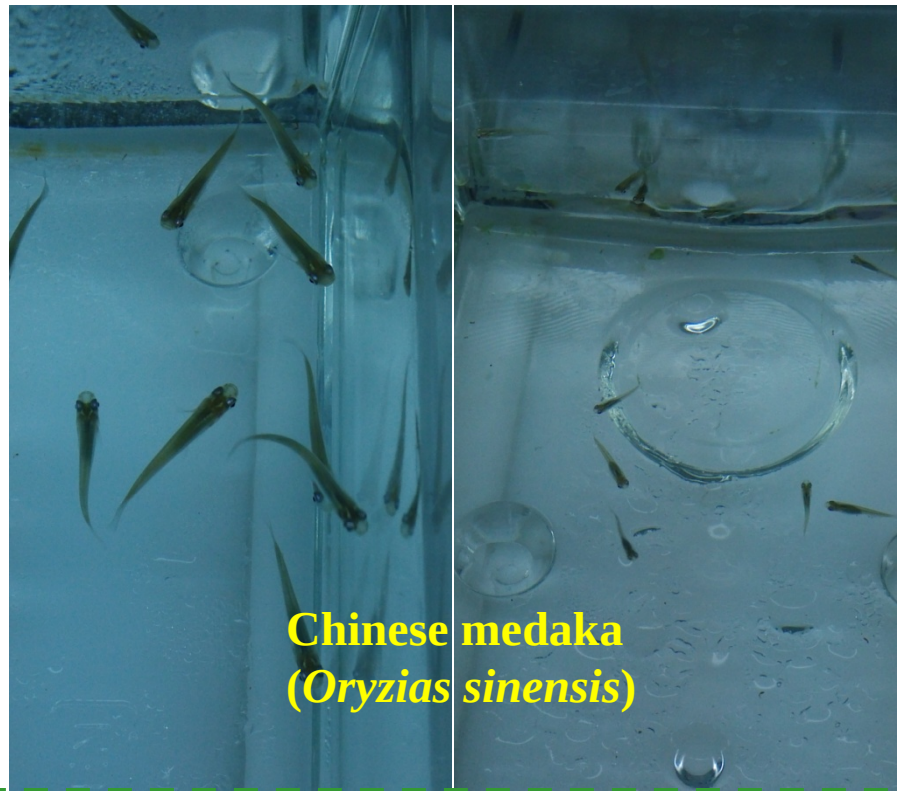
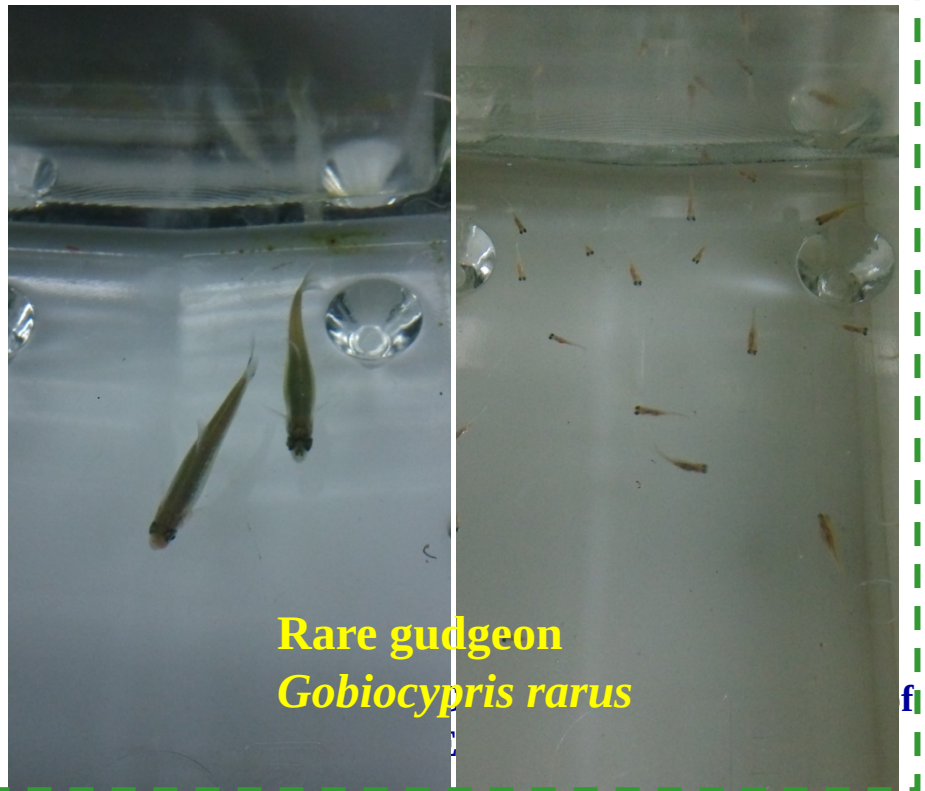
Co-operation: Suggestion

2. Breeding and testing method of native species for chemicals test

Two native fishes (Chinese medaka (*Oryzias sinensis*), Rare gudgeon (*Gobiocypris rarus*)) were bred in our laboratory. The experience of breeding and testing methods of Japanese medaka (*Oryzias latipes*) will be helpful to make Chinese medaka (*Oryzias sinensis*) a standard testing organism.



Chinese medaka
(*Oryzias sinensis*)

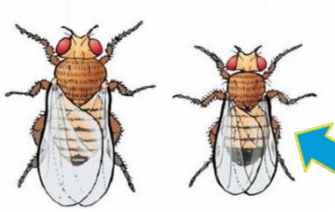


Rare gudgeon
Gobiocypris rarus

Co-operation: Suggestion

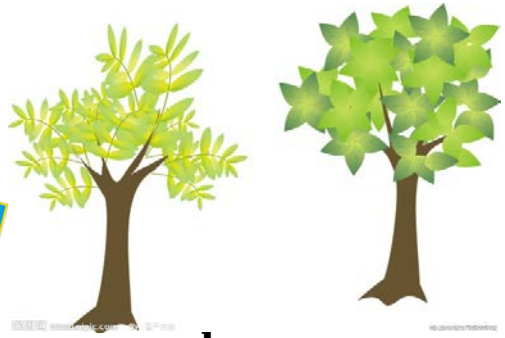
3. Toxicity test method of chemicals in the atmosphere

Environmental issues caused by chemicals and particulate matters in the atmosphere have garnered increased attention from the government and the society in China. However, there are no standard ecotoxicology testing guidelines. Therefore, feasible method for ecotoxicology test will be helpful to due with the problem generated by chemicals and particulate matters in the atmosphere.



animals

toxicity of chemicals and particulate matters



plants

ny of

Co-operation: Suggestion

4. GLP laboratory establishment

Our GLP laboratory could provide service of chemical test for customers (including some Japanese companies, etc.). In the future, the experience of establishment of GLP laboratory in Japan and Korea will be helpful to the development and improvement of our laboratory.

Co-operation: Suggestion

5. Estimation method of toxicity

Estimation methods for risk assessment and toxicity of chemicals (specie — another specie, physico-chemical properties — toxicity, structure — toxicity, QSAR, structure — biodegradation, estimation software and modeling, etc.) will be helpful to assess the risk and predict the toxicity of chemicals.

Thank You !

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