

# Importance of Chemical Management based on Risk Assessment

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# Development of Chemical Industry and their Adverse Effects on the Environment

- 1) forest destruction due to the mass consumption of woods for iron and ship building(13<sup>th</sup> century ,England)
- 2) development of iron manufacturing procedure with coke instead of wood (1735)
- 3) use of gases evolved during coke manufacturing process as gas lamp(1800)
- 4)bad smell and adverse effects on aquatic organisms due to dumping coal tar into River Thames
- 5) distillation of coal tar and the development of coal chemistry

# Development of Organic Chlorine Compounds

- 1) synthesis of DDT(1874)
- 2) discovery its use as insecticide (1938)
- 3) awarded Nobel Prize for the discovery
- 4) Widely use as “miracle chemical” against noxious insects
- 5) prohibited in almost all developed countries because of its persistence ,high bioaccumulation and toxicity other than targeted organisms
- 6) PCBs are also prohibited due to the similar properties

# Development of Polymer Chemistry

- 1) Bakelite was synthesized from Phenol and Formaldehyde under high temperature and pressure (1909)
- 2) Nylon was invented by Carothers (1938)
- 3) 14 million tons of plastics are being used in Japan
- 4) Its stable property in the environment caused the “microplastics problem”

# history of DDT

- 1) 1874 synthesized by German chemist
- 2) 1939 discovery its insecticidal property by Muller
- 3) 1948 Muller was awarded Nobel Prize
- 4) 1962 “Silent Spring” was published by  
R.Carson
  
- 5) 1948—1971 registered as insecticide in Japan
- 6) 1981 Class 1 specified Chemical Substance under  
CSCL
- 7) 2004 Designated as POPs under Stockholm  
Convention

# use of DDT and its toxicity

(use)

agricultural insecticide

(toxicity)

1) LD-50      113mg/Kg body weight (rat, oral)

2) 48LC-50    0.11ppm (carp)

3) ADI                      0.005mg/Kg/day

4) ACGIH                1 mg/m<sup>3</sup>

(environmental fate)

highly persistent, highly accumulative

(lessons learned)

consideration of adverse effects other than the targeted organisms

# history of PCB

- 1)1929      manufactured in USA
- 2)1954      manufactured in Japan
- 3)1966      detected in the body of birds and fish
- 4)1968      Yushou incident
- 5)1978      Class 1 specified Chemical Substance under CACL
  
- 6)2004      designated as POPs under Stockholm Convention

(Total production volume in Japan 59,000 ton 1954-1972)

# use of PCB and its toxicity

(use)

condenser oil, pressure-sensitive paper, heating fluid

(toxicity)

LD-50 1,000~3,000mg/Kg体重

IARC 2A ( Probably Carcinogenic )

(environmental fate)

persistent, highly bioaccumulative

(lessons learned)

need to consider general environmental exposure route

discrimination of acute and chronic toxicity (less acute toxicity ,high chronic toxicity)



# unintentionally produced chemicals

## 1) dioxins

produced from

combustion

chlorine bleaching

impurity of pesticide

## 2) trihalomethanes

produced from

purification of tap water with chlorine

(lessons learned)

need for the risk evaluation of unintentional products also

# history of CFCs

- 1) 1931            begin to manufacture industrially
- 2) 1941            awarded Priestley medal
- 3) Early 1970s    detected in the atmosphere
  
- 4) 1974            point out the destruction of ozone layer  
and the possible adverse effects on human health  
and the environment
- 5) 1985    Wien Convention for the protection of Ozone  
layer
- 6) 1989            Montreal protocol
- 7) 1996            awarded Nobel Prize

# use of CFCs and their properties

(use)

refrigerant, cleaning agent, foaming agent, propellant

(property)

tasteless, odorless, non toxic, inflammable,  
low thermal conductivity, low surface tension ,  
low boiling point

(environmental fate)

persistant, low bioaccumulative

(lessons learned)

adverse effects on physical environment rather than human health  
(destruction of stratosphere ozone layer)

# measures taken in Japan

**1) amendment of Agricultural Chemicals Regulation Law(DDT)**

**2) enactment of Chemical Substances Control Law (PCB)**

**3) enactment of Dioxins Regulation Law(Dioxins)**

**4) enactment of Ozone Layer Protection Law (CFCs)**

## **The WSSD 2020 goal to minimize significant risk(2002)**

**World Summit of Sustainable Development (WSSD) made a commitment to the sound management of chemicals throughout their life cycle, “aiming to achieve, by 2020, that chemicals are used and produced in ways that lead to the minimization of significant adverse effects on human health and the environment.”**

# risk assessment

1) expressed as a function of hazard and exposure

2) the precision of the data used for risk assessment should be evaluated

Hazard data : animal experiment , epidemiology

Exposure data: mostly based on hypothesis

Is risk assessment really useful and effective?

# Risk –based regulation

**Can we control exposure ?**

**Is risk –based regulation really effective  
to protect human health and environment ?**

**(proposal)**

**significant hazardous chemical substances  
should be regulated regardless exposure .**

# from regulation to self-initiative

## 1)1970 s: Era of Regulation

Regulation of Hazardous substances

## 2)1990s: Era of regulation and Self-Initiative

Control of exposure



# regulation and self-initiative (1)

## 【regulation】

(points of excellence)

1) certain results with legal enforcement

2) no arbitrarily administration

(weak points)

1) high cost for implementation

2) difficult to correspond quickly

3) low level of standard (national minimum)

# regulation and self-initiative (2)

## 【Self-initiative】

(points of excellence)

- 1) lower administrative cost compared with regulation
- 2) best method can be adopted by each company

(weak points)

- 1) no administrative power for free-rider company
- 2) without transparent evaluation system, self-initiative may loose social trust

# enactment of Law for the Regulation of Chemical Substances

## Developed countries

- 1974 Japan
- 1977 USA
- 1978 EU(6<sup>th</sup> amendment)
- 1988 Canada
- 1990 Australia
- 2007 EU(REACH)

## Developing countries

- 1990 Philippines
- 1991 Korea
- 2003 China

# need for the enhancement of Risk communication

**20<sup>th</sup> century :era of safety**

**21<sup>st</sup> century :era of safety and sense of  
security**

**Risk communication**

**:Bridge connecting safety and sense of  
security**

# definition of risk communication

(NRC1989)

**An interactive process of exchange of information and opinion among individuals, groups and institution.**

# **Aureolus Theophrastus Paracelsus**

**(Swiss 1493-1541)**

**What is there that is not  
poison ?**

**All things are poison and  
nothing without poison.**

**Solely , the dose determines  
that a thing is not a poison.**

# Torahiko Terada



一生、ずっと続くチカラを。  
秋草学園短期大学  
Akikusa gakuen

(Japanese 1878~1935)

**It is very easy to worry about matters too much , or less frightened.**

**However,**

**it is very difficult to worry about matters rationally.**