Survey On Dioxin of Environmental plant

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Introduction

We have reviewed the recent processes in the field of organic pollutant accumulation in vegetation.[1-3] However , few of them covered on the topics of phyto-remediation over Dioxin pollution.EAL has been monitoring over certain polluted sites of pentachloro-phenol factory in southern Taiwan. It brought to our interest that the plants distributed in a peculiar way. We observed both single vegetation zone and zone that symbiosis occured. To get a better understanding over the implicit effects behind these observations, EAL has initiated a project collect ten kinds of plant samples including tappa (*Boussonetiapapyrifera*), common jasmin orange (*Murrayapaniculata*) and so on in several specific areas. Dioxin content in these pants ranged from 12.7 to 2919 average 463 n =16 ng WHO-TEQ$_{DF}$ /kg d.w. and DL-PCBs 0.236 ~1.75 average 0.605 n=8 ng WHO-TEQ/ kg d.w.

Methods and Materials

Samples

Sixteen plant samples from in various parts of 10 kinds of plants were collected from the Dioxin polluted sites thathave been assorted into the medium- and high- contaminated zones in 2002.All samples were washed with water before further pretreatment.

Analytical Methods

We adopted USEPA M1613B[4] and M1668A[5] as the analytical method in this project. Samples were chopped, homogenized, dried and ground into fine particle. Then weighed proper amount or approximately 5~10 g of dry sample and put them into cellulose thimbles. Isotope standards (M1613-IS for Dioxin and M1668-IS for PCBs) were added into thimbles. Then extract them by Soxhlet extractors with acetone/n-hexane 1:1 in 70℃ water bath for 24 hours. Vacuum concentrate the distillates. After the addition of clean -up recovery standards, clean up the concentrates with acidic silca gel, sulfuric acid/silica gel column, then AX -21 carbon column eluted 50% benzene/DCM for PCBs then reversed the column elute with toluene for dioxins. The final extract was reduced in volume by a stream of nitrogen; Finally add recovery standards of analyze the Dioxin and toxic PCBs and analyze its concentration utilizng HRGC/HRMS Micromass Ultima .

Results and Discussion

Results

Plant samples collected from medium contaminated area dioxin concentration in soil ranged from 100~900 ng I -TEQ/kg were reed, sandbur, *Physalisangulatal* and nightshade. The dioxin concentration of the plant samples were ranged from 12.7~632 ng WHO - TEQ$_{DF}$/kg d.w.. Plant samples collected from higher contaminated area dioxin concentration in soil ranged from 1000~1100000 ng I - TEQ/kg were tappa *Boussonetiapapyrifera(L.)* , common jasmin orange, Casuarinaeguisetifolia, *Albizialebbeck*, Bidenschilensis, Momordicacharantia. The dioxin concentration of the plant samples were ranged from 152~1784 ng WHO -TEQ$_{DF}$/kg d.w.. The highest dioxin concentration was the leaf of *Boussonetiapapyrifera(L.).,* which concentration was 2919 ng WHO-TEQ$_{DF}$/kg d.w.. Followed by the root of *Physalisangulatal* ,which concentration was 1136 ng WHO - TEQ $_{DF}$/kg d.w.. The percentage contribution of each 2,3,7,8 - substituted PCDD/Fs in plants and soil samples from medium and higher contration area were presented in Fig.1. The profile of all samples are the same. The highest concentration contribution is OCDD and OCDF, followed by 1,2,3,4,6,7,8-HpCDD AND 1,2,3,4,7,8,9-HpCDF. The ratios of DLPCBs to Dioxin were around 0.037~2.67% as shown in table 2. The concentrations and percentage contributed of DL PCBs congener to the total sum were presented in Fig.2. The highest concentration is PCB#118, followed by PCB#105, PCB#77

Discussion

Organic pollutants such as Dioxin, PCBs and PAHs may diffuse into air or soils through various pathways and then be absorbed by plants. Eventually, they may influence human health by way of food chain.[6] Besides, it is found that the concentration of chlorine containing toxic chemicals that have structures similar to Dioxin such as DDT, DDE, DDD and so on are astonishingly high in the vascular strands of the plants. [7] Based on these findings, it seems that the contents of Dioxin in plants may have close connection to the surrounding environments that they grow.

Tappa is one of the most commonly seen plants and grow quickly in Taiwan. Its best potential tolerance to environmental contaminates is quite strong too. This is one of the best species that can absorb and adsorb Dioxin effectively. And may be the best plants for Dioxin phytoremediation. *Physalisangulatal* also has good adaptive characteristic. Its whisker root can adsorb pollutants in great amount. When extensively planted, it will be excellent candidate for the removal of shallow polluting materials.

Concentration range of Soil Area	Scitific Name	Root	Stem & Leaf	Leaf	Stem	Full Plant	Average
1000~1000000 ng I-TEQ$_{DF}$/kg d.w.	*Boussonetia papyrifera(L.)*	649	---	2919	---	---	1784
	Murraya paniculata Jack. Var. paniculata	---	---	602	190	---	396
	Momordica sp.	---	172	331	---	---	252
	Bidens pilosaL.	---	152	---	---	---	152
	Casuarina equisetifolia Forst.	---	---	315	44.7	---	180
	Albizia lebbeck (Willd.) Benth	---	---	258	---	---	258
100~1000 ng I-TEQ$_{DF}$/kg d.w.	*Phargmites communis(L.) Trin*	---	---	---	---	21.0	21.0
	Zoysia SP.	---	---	---	---	12.7	12.7
	Physalis angulatal	1136	127		---	---	632
	Solanum nigrum L.	401	79.5	---	---	---	240

Table 1. Dioxin Concentration ng TEQ$_{DF}$/kg d.w. in Various Parts of Plants.

Name	*Phargmites communis(L) Trin*	*Zoysia SP.*	*Momordica sp.*		*Physalis angulatal*		*Murraya paniculata Jack. Var. paniculata*	
			(leaf)	(stem)	(leaf & stem)	(root)	(leaf)	(stem)
ΣTEQ_F	13.4	7.30	152	82.5	87.0	681	367	115
ΣTEQ_D	7.61	5.43	179	89.3	39.8	455	235	74.6
ΣTEQ_{DF}(A)	21.0	12.7	331	172	127	1136	602	190
ΣTEQ_{PCBs}(B)	0.560	0.330	0.618	0.236	0.360	0.426	1.75	0.509
(B)/(A) *100%	2.67	2.59	0.187	0.138	0.284	0.037	0.291	0.269

Table 2. The Concentration ng TEQ$_{DF}$/kg d.w. of Dioxin and DLPCBs Data in Plants.

References

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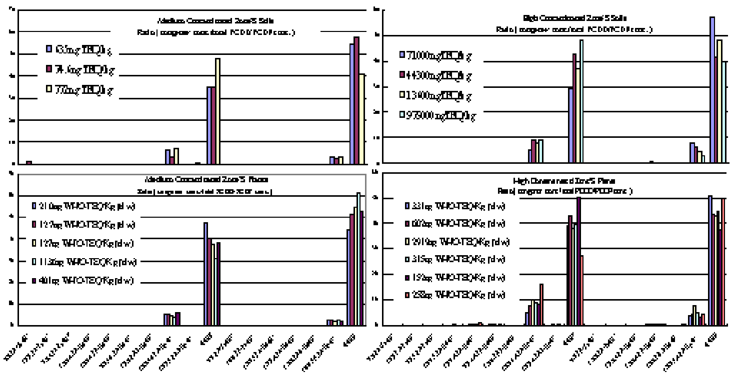

Figure 1. The percentage contribution of each 2,3,7,8-substituted PCDD/Fs in plants and soil from medium and higher contaminated area

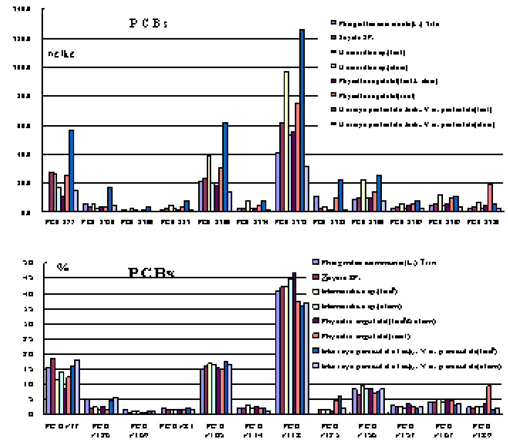

Figure2、The concentrations (upper) and percentage(lowerer) contribution of each DLPCBs congener to the total sum.