For Environmental Seminar in EiMAS in June

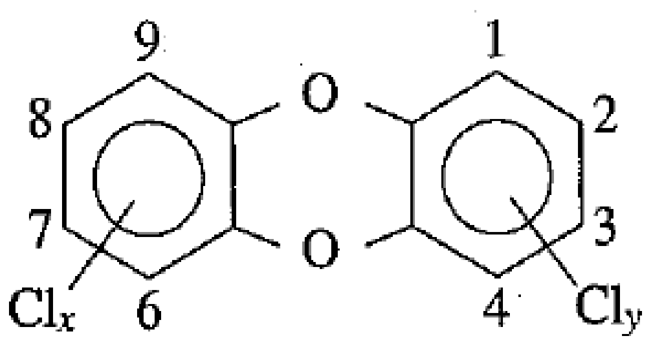
Types of filters used to control incinerations' gaseous emission especially dioxins

June 16, 2011

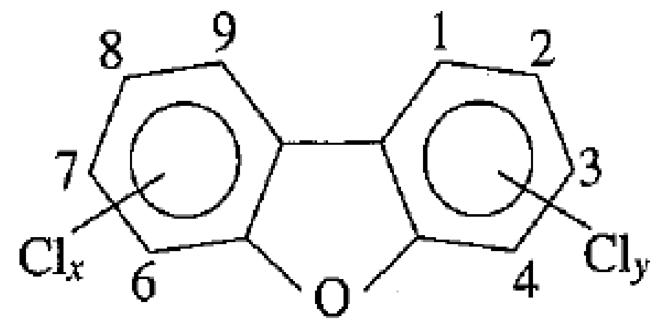
Japan Environmental Management Association for Industry (JEMAI)

Contents

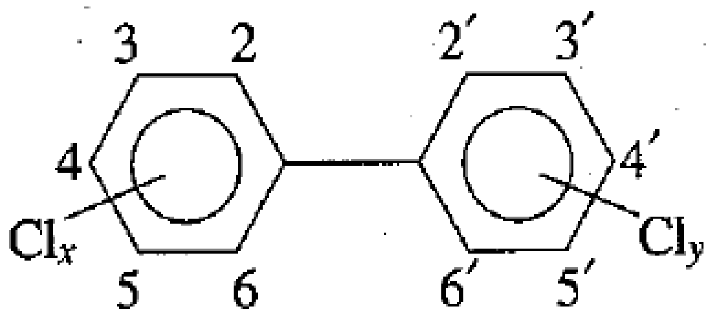
Chemical structure of Dioxins



(a) **PCDDs**



(b) **PCDFs**



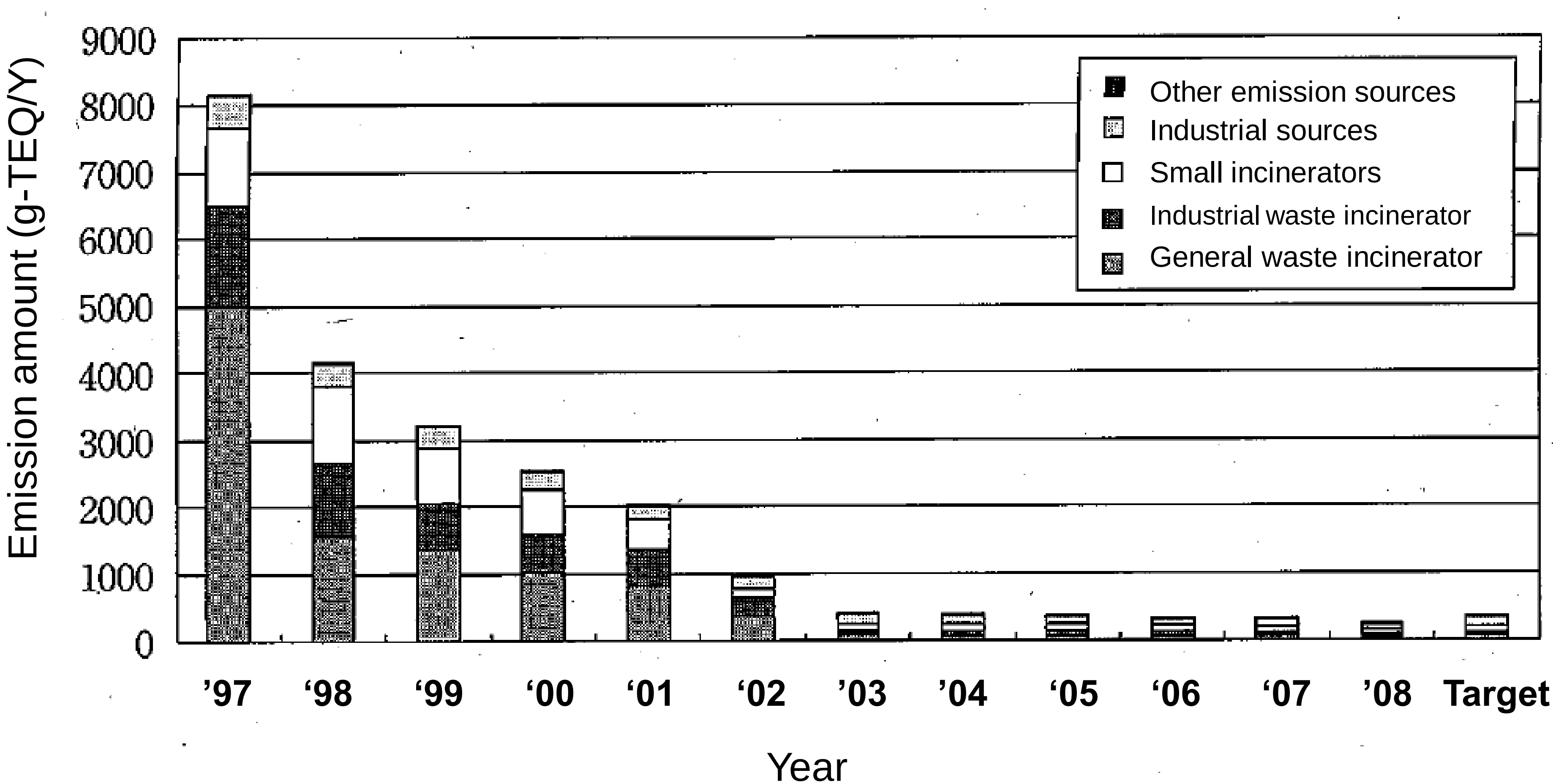
(c) **Coplanar PCBs**

Toxic Equivalency Factor of Dioxins (TEF)

Isomer		mark	TEF*
PCDDs		2,3,7,8-TeCDD	1
		1,2,3,7,8-PeCDD	1
		1,2,3,4,7,8-HxCDD	0.1
		1,2,3,6,7,8-HxCDD	0.1
		1,2,3,7,8,9-HxCDD	0.1
		1,2,3,4,6,7,8-HpCDD	0.01
		1,2,3,4,6,7,8,9-OCDD	0.0003 (0.0001)
PCDFs		2,3,7,8-TeCDF	0.1
		1,2,3,7,8-PeCDF	0.03 (0.05)
		2,3,4,7,8-PeCDF	0.3 (0.5)
		1,2,3,4,7,8-HxCDF	0.1
		1,2,3,6,7,8-HxCDF	0.1
		1,2,3,7,8,9-HxCDF	0.1
		2,3,4,6,7,8-HxCDF	0.1
		1,2,3,4,6,7,8-HpCDF	0.01
		1,2,3,4,7,8,9-HpCDF	0.01
		1,2,3,4,6,7,8,9-OCDF	0.0003 (0.0001)
Coplanar PCBs	Non-ortho	3,4,4′,5-TeCB	0.0003 (0.0001)
		3,3′,4,4′-TeCB	0.0001
		3,3′,4,4′,5-PeCB	0.1
		3,3′,4,4′,5,5′-HxCB	0.03 (0.01)
	Mono-ortho	2′,3,4,4′,5-PeCB	0.00003 (0.0001)
		2,3′,4,4′,5-PeCB	0.00003 (0.0001)
		2,3,3′,4,4′-PeCB	0.00003 (0.0001)
		2,3,4,4′,5-PeCB	0.00003 (0.0005)
		2,3′,4,4′,5,5′-HxCB	0.00003 (0.00001)
		2,3,3′,4,4′,5-HxCB	0.00003 (0.0005)
		2,3,3′,4,4′,5′-HxCB	0.00003 (0.0005)
		2,3,3′,4,4′,5,5′-HpCB	0.00003 (0.0001)

Contents

Trend of emission of Dioxins from 1997 to 2008 in Japan



Dioxins’ concentration in flue gas from general waste incinerators

Installed by municipalities

Capacity of incineration	Number of investigated incinerators	Dioxins’ concentration in flue gas (ng-TEQ/m^3_N)		
		Average	Median	Min. ～ Max.
≧ 4 t/h	673	0.04	<0.01	<0.01～1.4
2 t/h ≦ & < 4 t/h	897	0.35	0.06	<0.01～2.6
< 2 t/h	594	0.57	0.10	<0.01～10
Total/average/range	2164	0.31	0.04	<0.01～26

Installed by industrial companies

Capacity of incineration	Number of investigated incinerators	Dioxins’ concentration in flue gas (ng-TEQ/m^3_N)		
		Average	Median	Min. ～ Max.
≧ 4 t/h	11	0.01	<0.01	<0.01～0.08
2 t/h ≦ & < 4 t/h	7	0.04	0.03	<0.01～0.14
< 2 t/h	50	0.75	0.18	<0.01～9.6
Total/average/range	68	0.56	0.03	<0.01～9.6

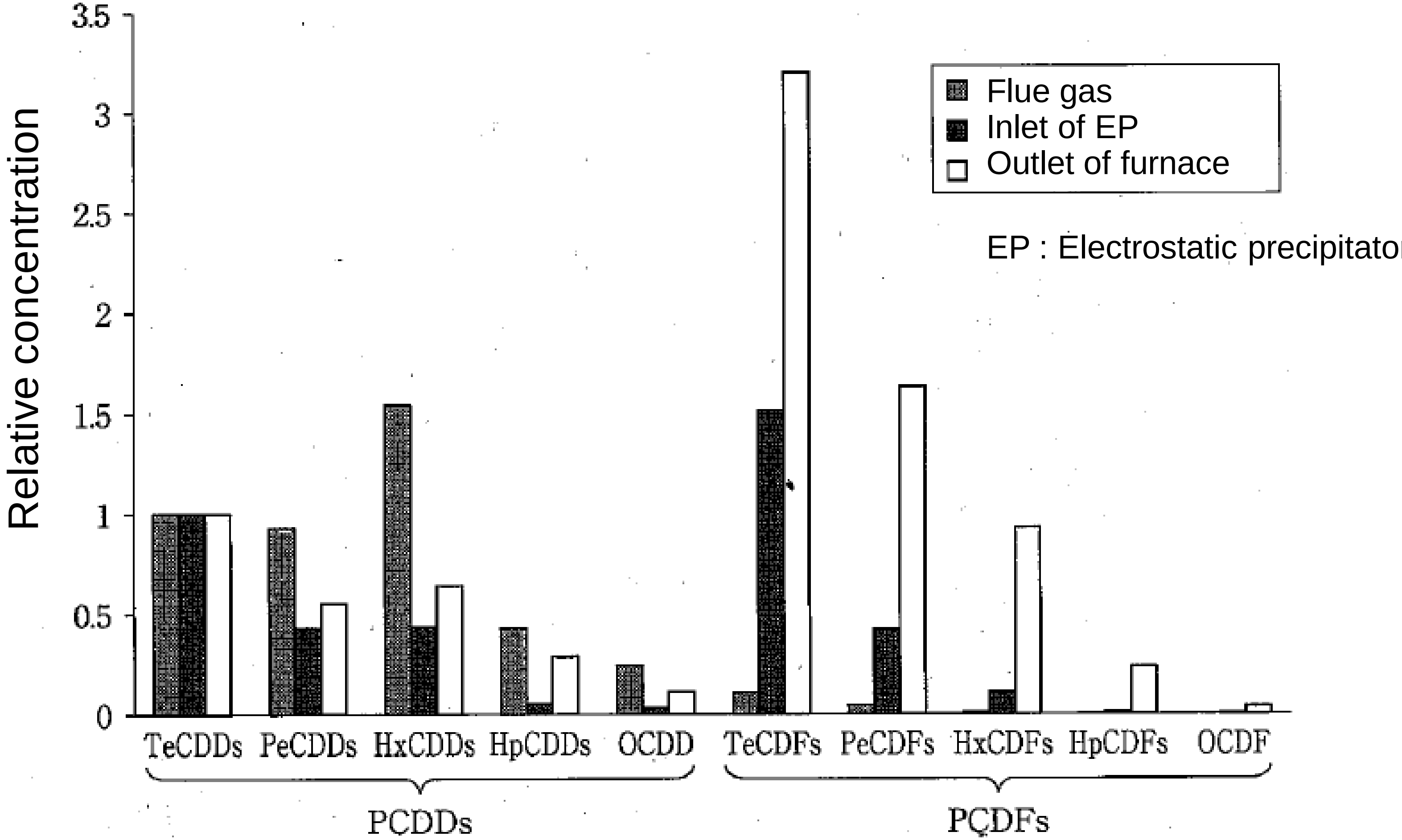
Dioxins' concentration in flue gas from industrial waste incinerators

From Apr.1, 2007 to Mar.31, 2008

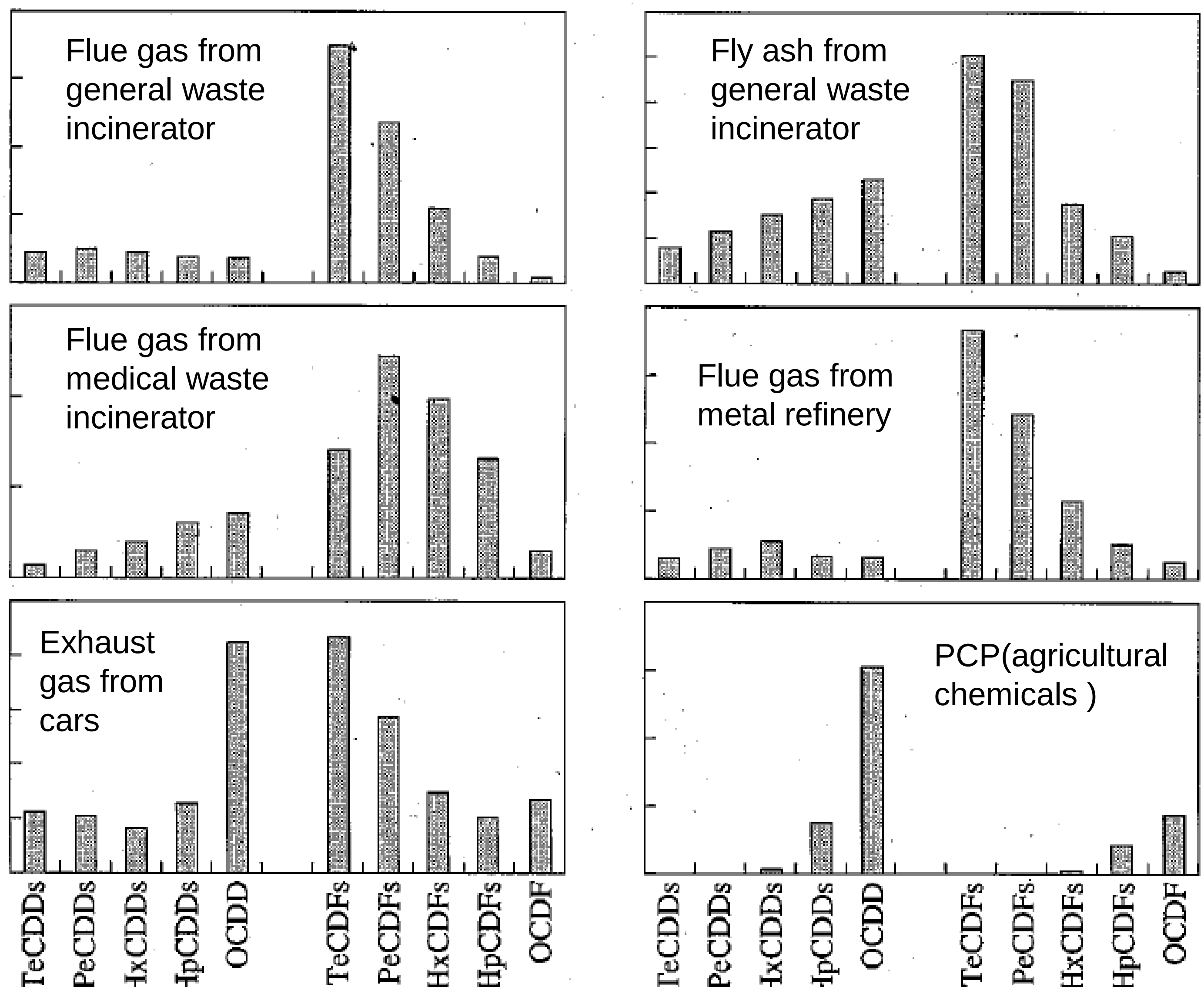
Dioxins' concentration (ng-TEQ/m^3_N) / Kinds of waste	≦0.1	0.1<, ≦ 1	1<, ≦ 5	5<, ≦10	10<, ≦40	40<, ≦80	80<	Total*	Average
Sludge	395 61.1%	162 25.0%	78 12.1%	8 1.2%	4 0.6%	0 0.0%	0 0.0%	647 100%	0.64
Waste oil	395 58.5%	183 27.1%	87 12.9%	9 1.3%	4 0.1%	0 0.0%	0 0.0%	678 100%	0.66
Waste plastics	397 48.7%	244 29.9%	148 18.1%	22 2.7%	4 0.5%	0 0.0%	1 0.1%	816 100%	1.14
Others (wood chip etc)	500 40.1%	380 30.5%	300 24.1%	56 4.5%	10 0.8%	0 0.0%	1 0.1%	1247 100%	1.39

Total* : Total of investigated incinerators

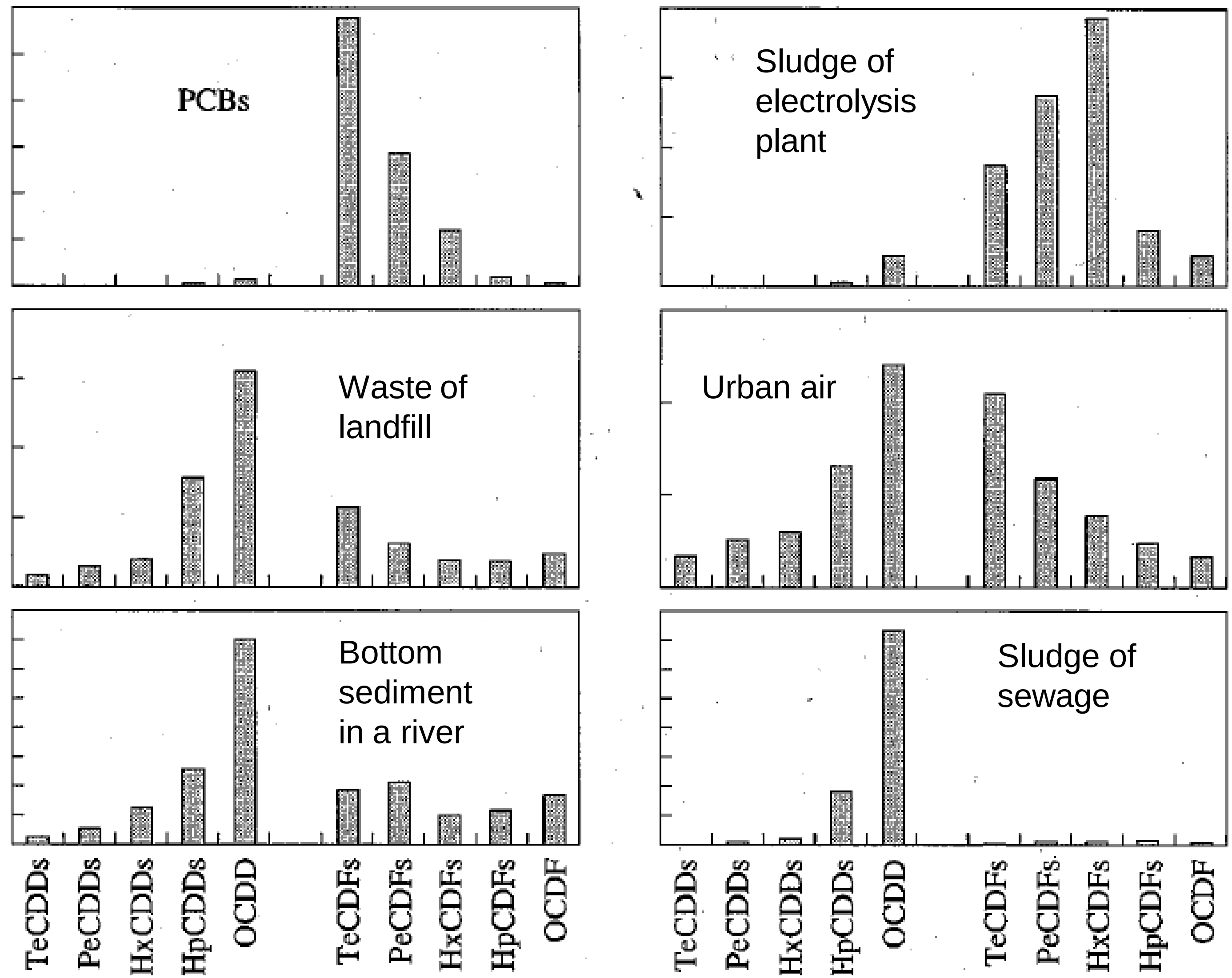
Example of dioxins' concentration difference according to points of waste incinerator



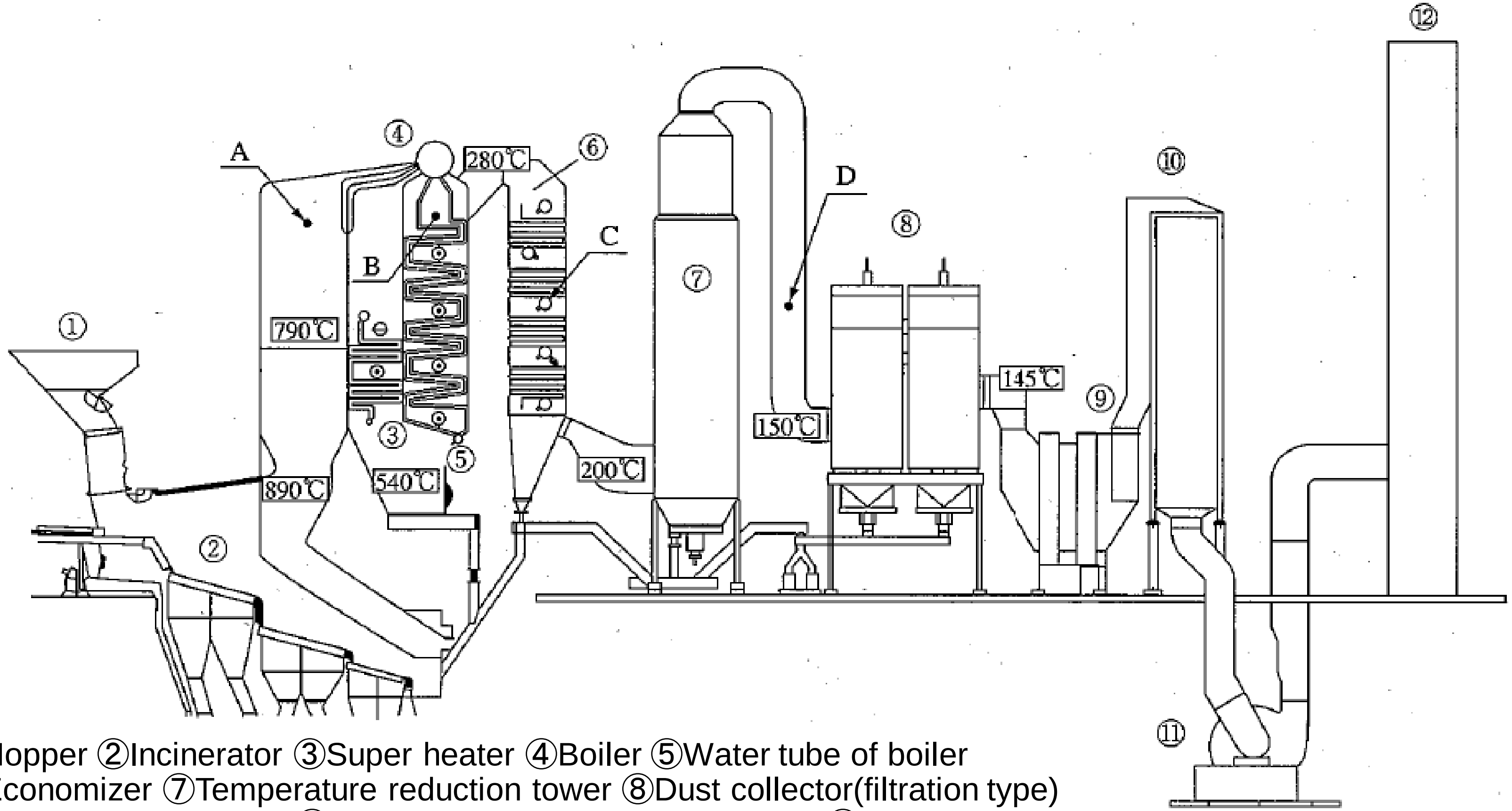
Examples of dioxins' concentration profile difference according to sources (1/2)



Examples of dioxins' concentration profile difference according to sources (2/2)



Example of dioxins' concentration in waste incinerator



①Hopper ②Incinerator ③Super heater ④Boiler ⑤Water tube of boiler
⑥Economizer ⑦Temperature reduction tower ⑧Dust collector(filtration type)
⑨Re-heater of flue gas ⑩Catalytic denitrification equipment ⑪Induced draft fan
⑫Chimney

		Temp. (℃)	PCDDs (ng-TEQ/m^3_N)		PCDFs (ng-TEQ/m^3_N)		PCDDs·PCDFs (ng-TEQ/m^3_N)		PCBs (ng/m^3_N)	PCP (ng/m^3_N)
			Solid	Gas	Solid	Gas	Solid	Gas		
A	Inlet of slag screen	750	0.15	0.15	0.29	0.38	0.44	0.53	4600	1300
B	Outlet of water tube	280	1.1	0.11	2.5	0.18	3.6	0.29	6200	2900
C	Middle of Economizer	230	1.0	0.080	1.6	0.11	2.6	0.19	4900	2300
D	Inlet of bag filter	150	1.1	0.047	1.8	0.063	2.9	0.11	5100	1800

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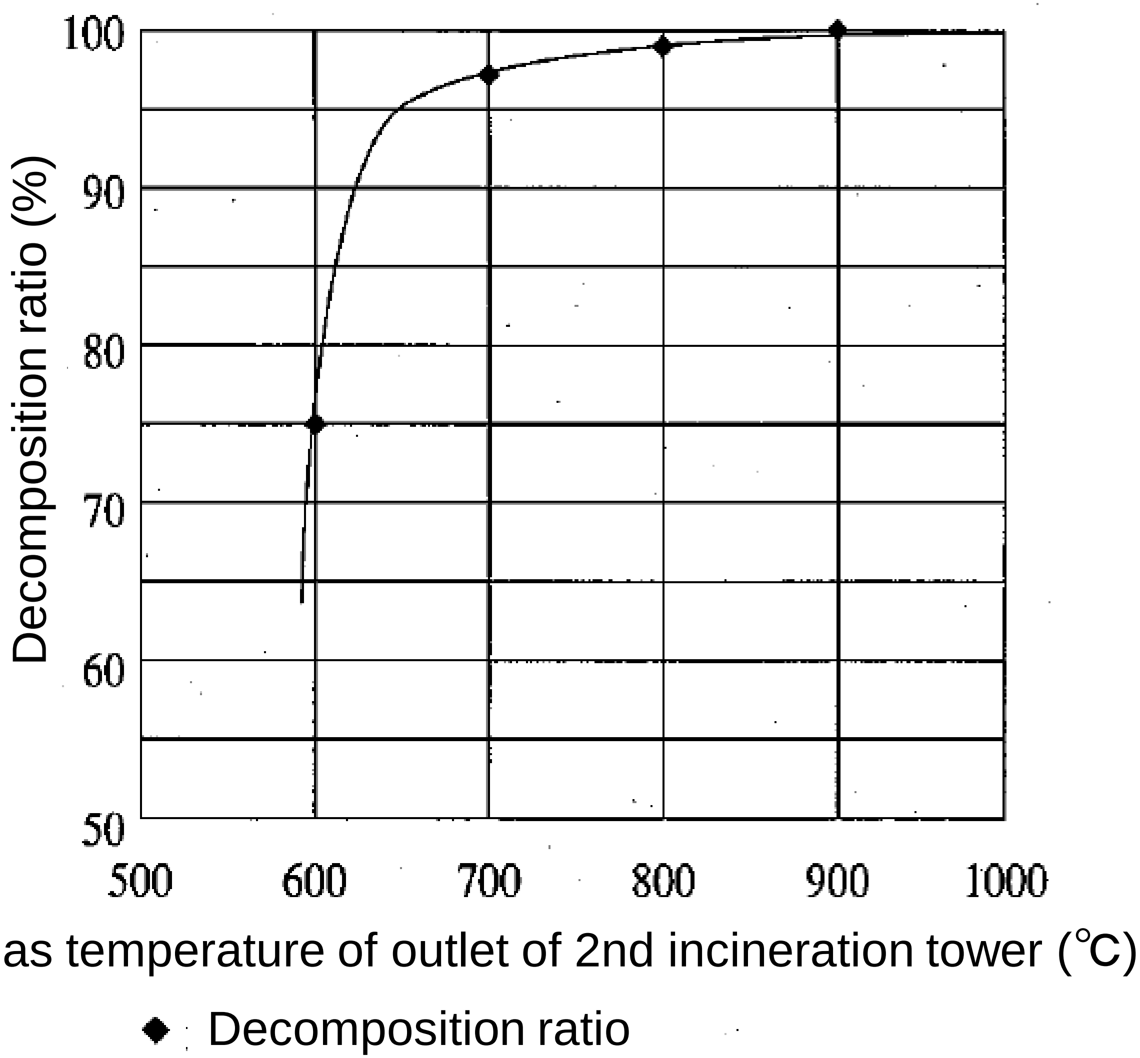
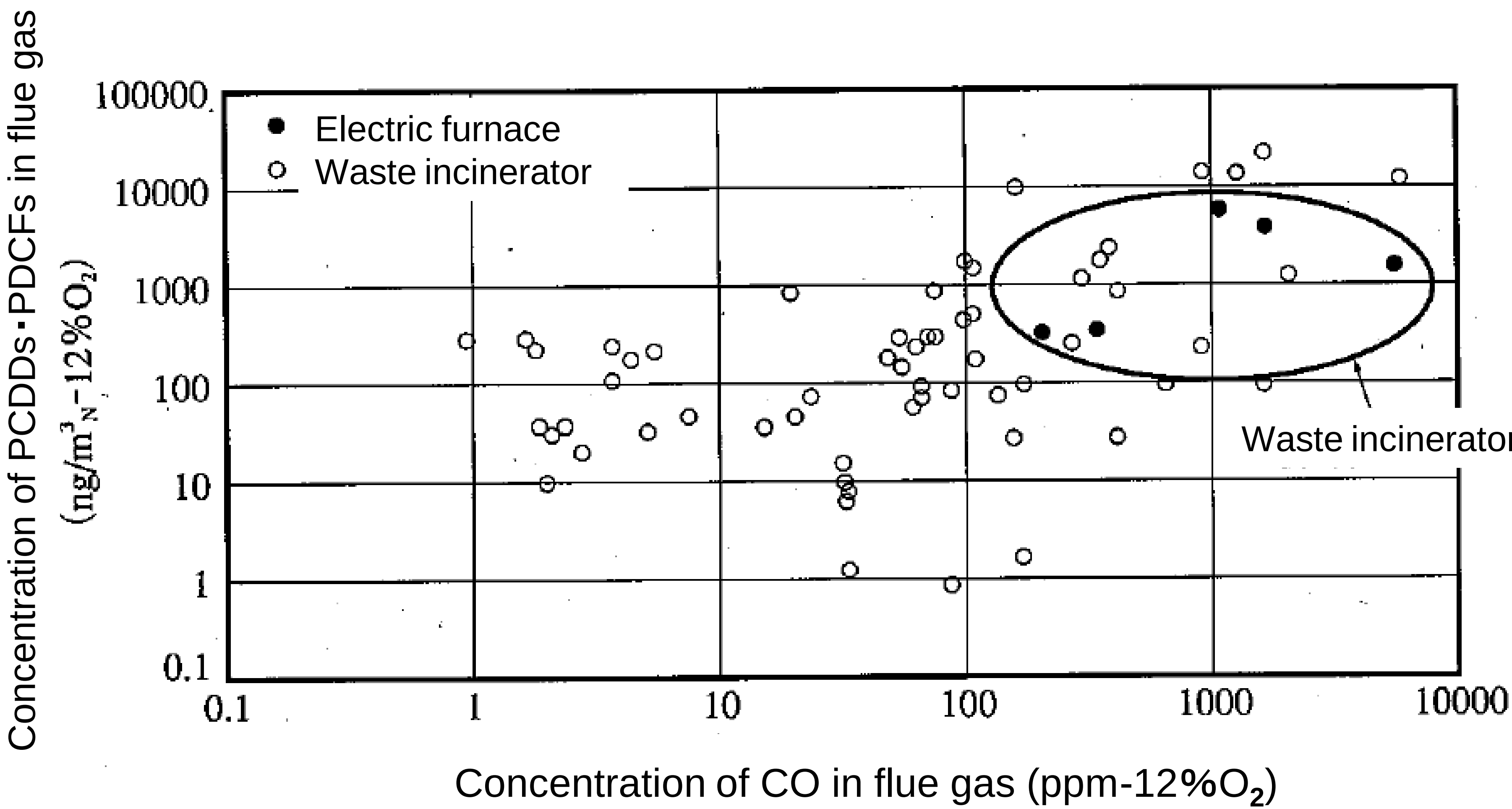
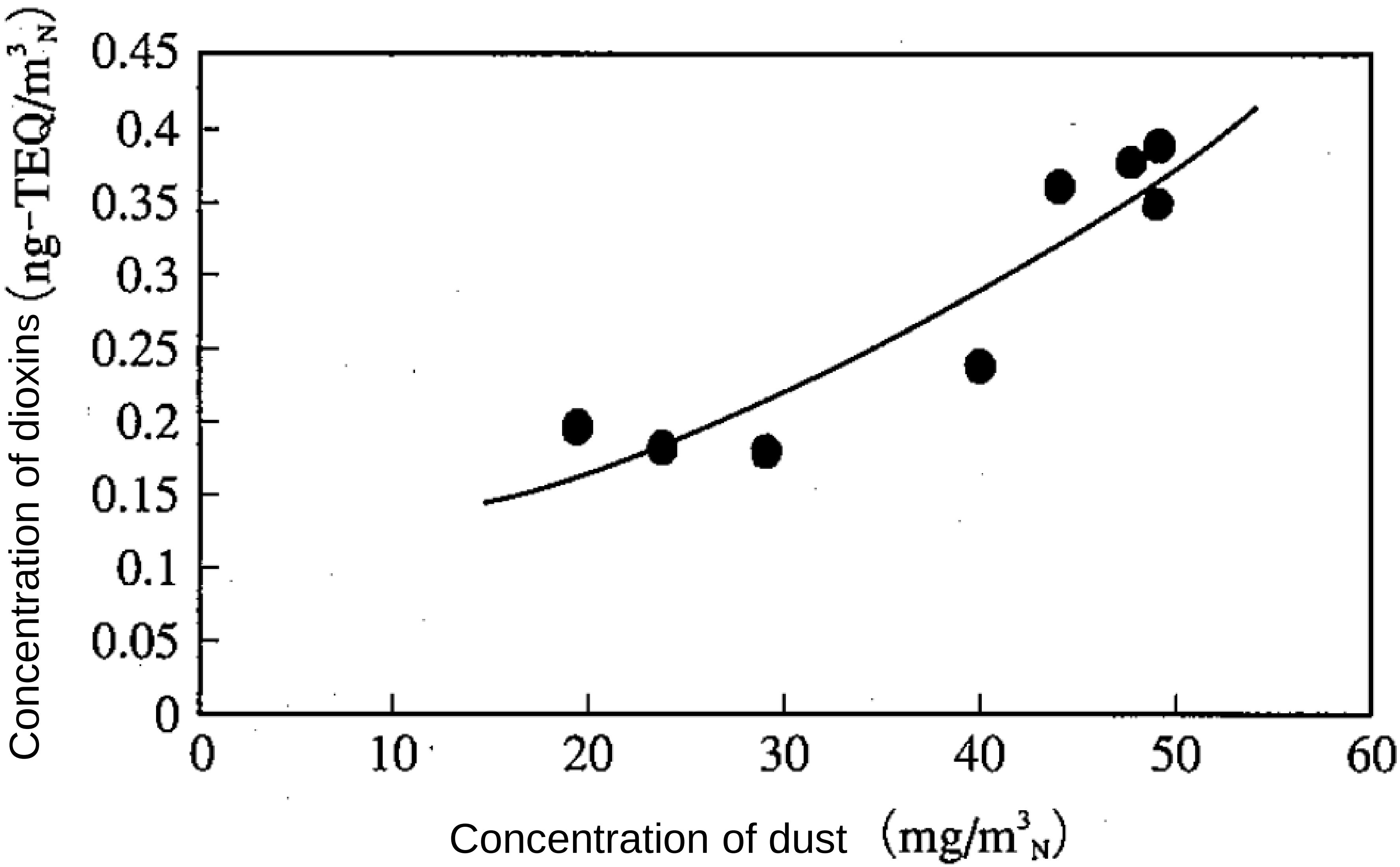
2nd incineration temperature of flue gas vs decomposition ratio of PCDDs・PCDFs



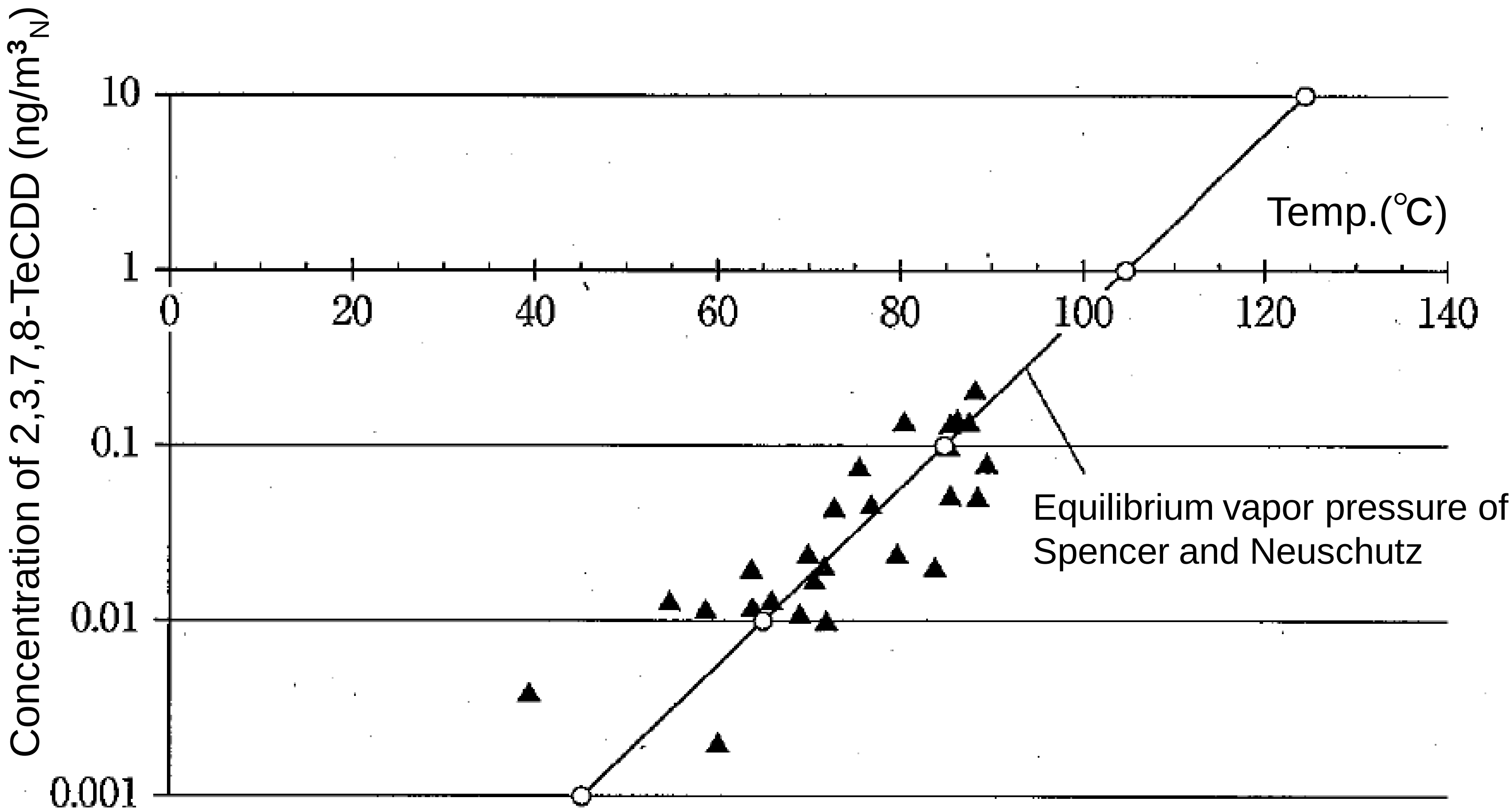
2nd incineration temperature of flue gas vs decomposition ratio of PCDDs･PCDFs



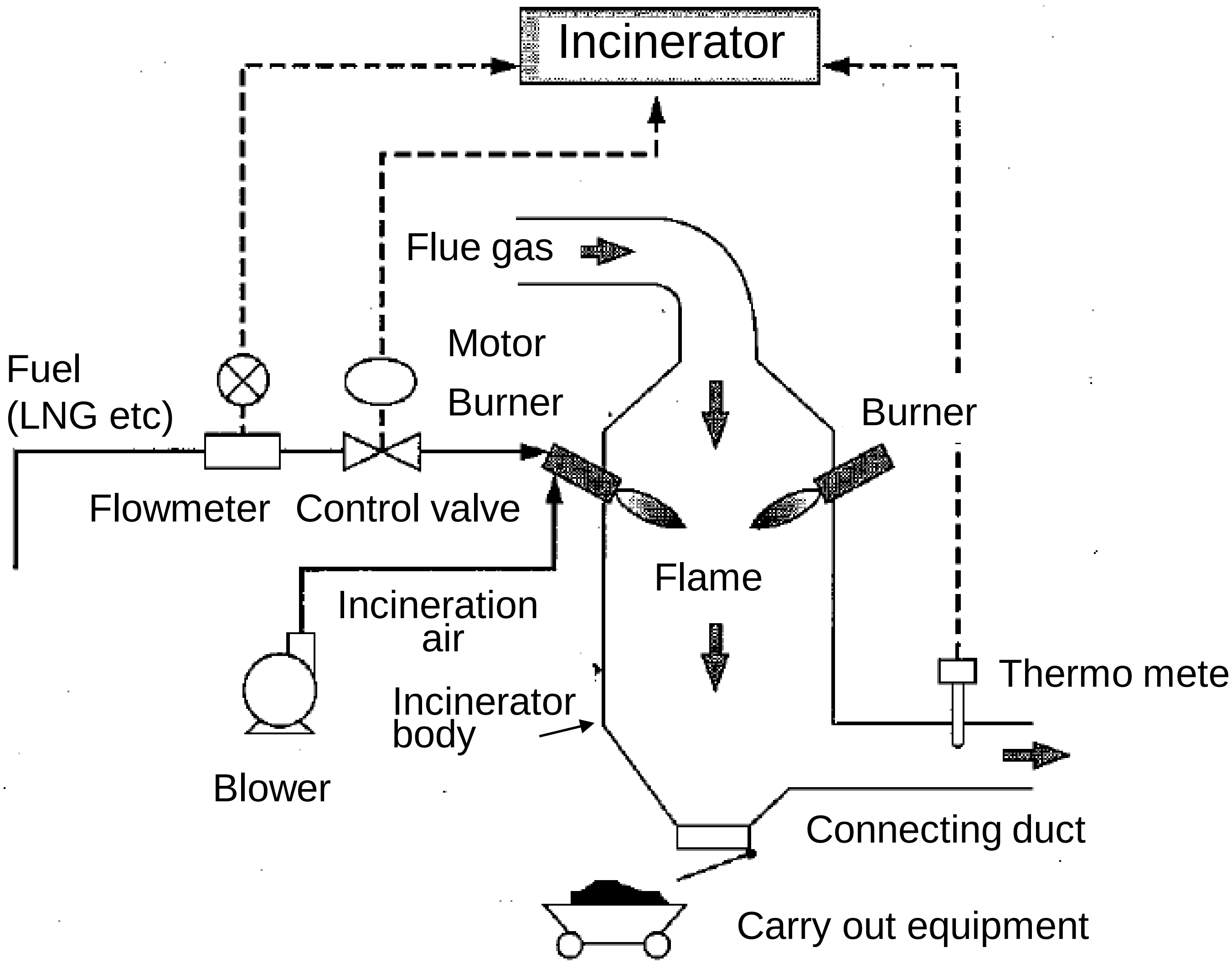
Relationship between concentration of dust and that of dioxins in flue gas after sintering furnace



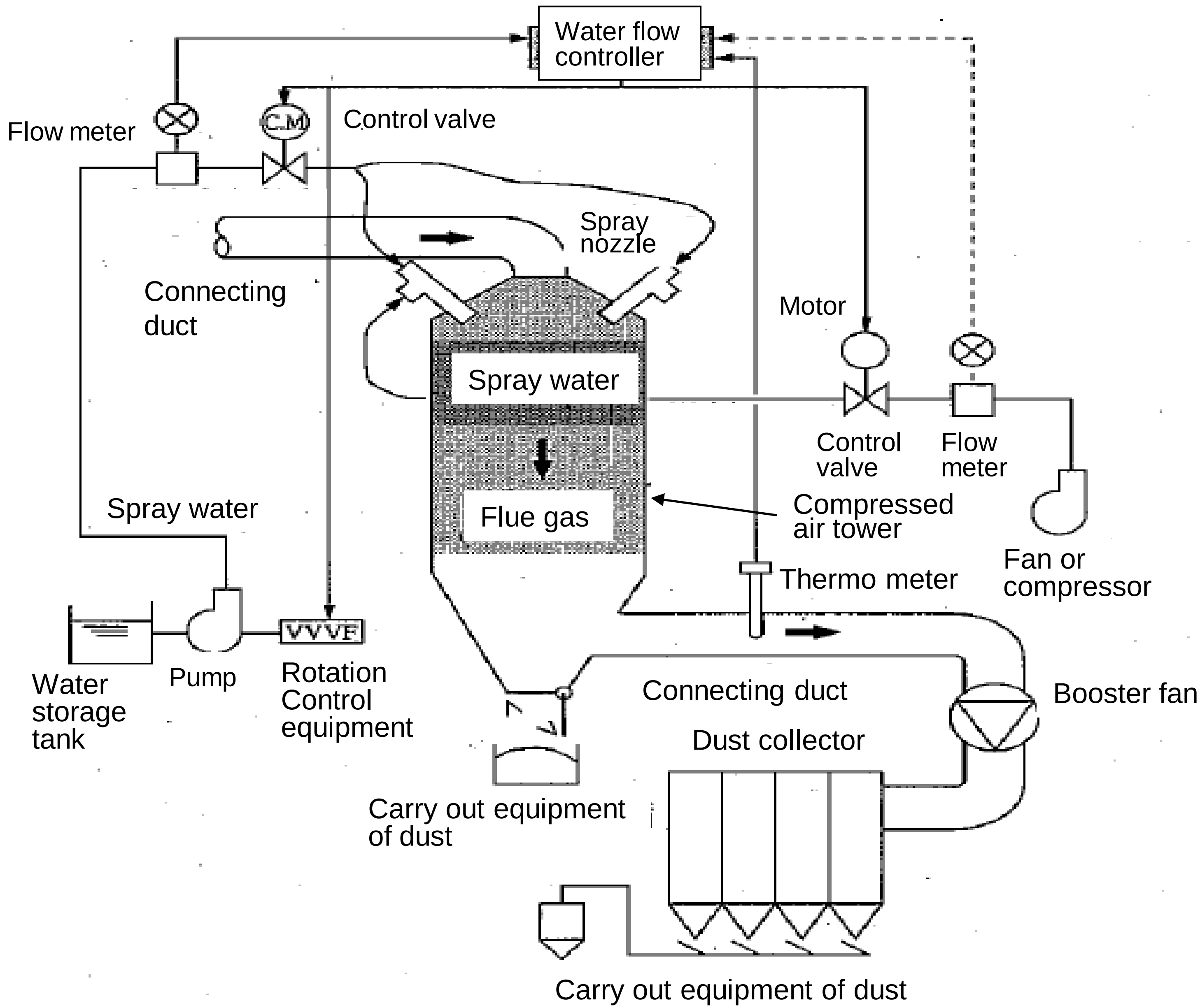
Relationship between concentration of 2,3,7,8-TeCDD in flue gas and temperature of that after outlet of dust collector



Example of 2nd Incineration



Example of cooling technology of Flue gas with water spraying



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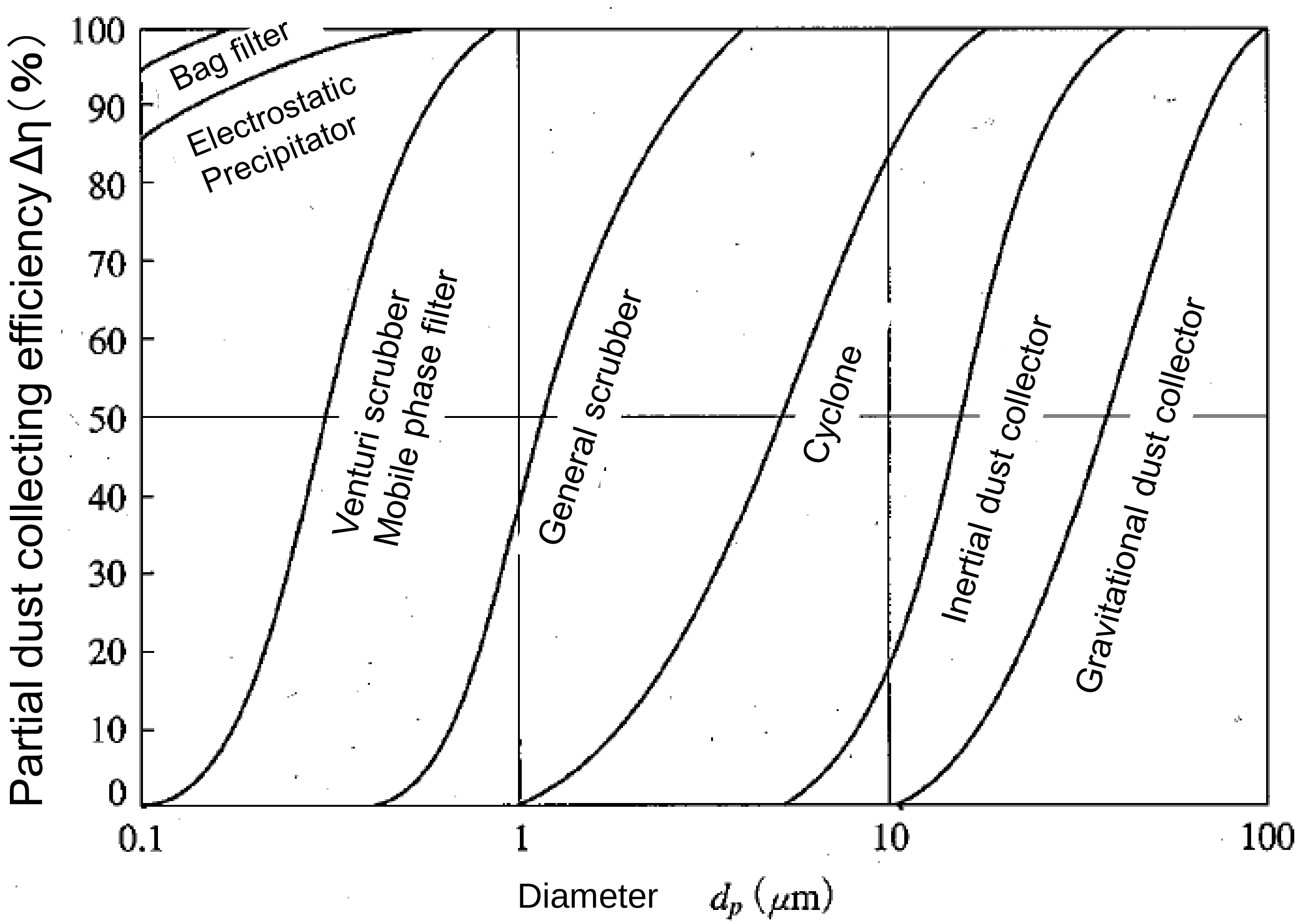
Efficiency of dust collectors



Dust accumulation process on filter cloth woven

Bumpy surface

Flat surface

Dust

Dust

(a) New filter cloth

(b) Growing period of 1st accumulation layer of dust

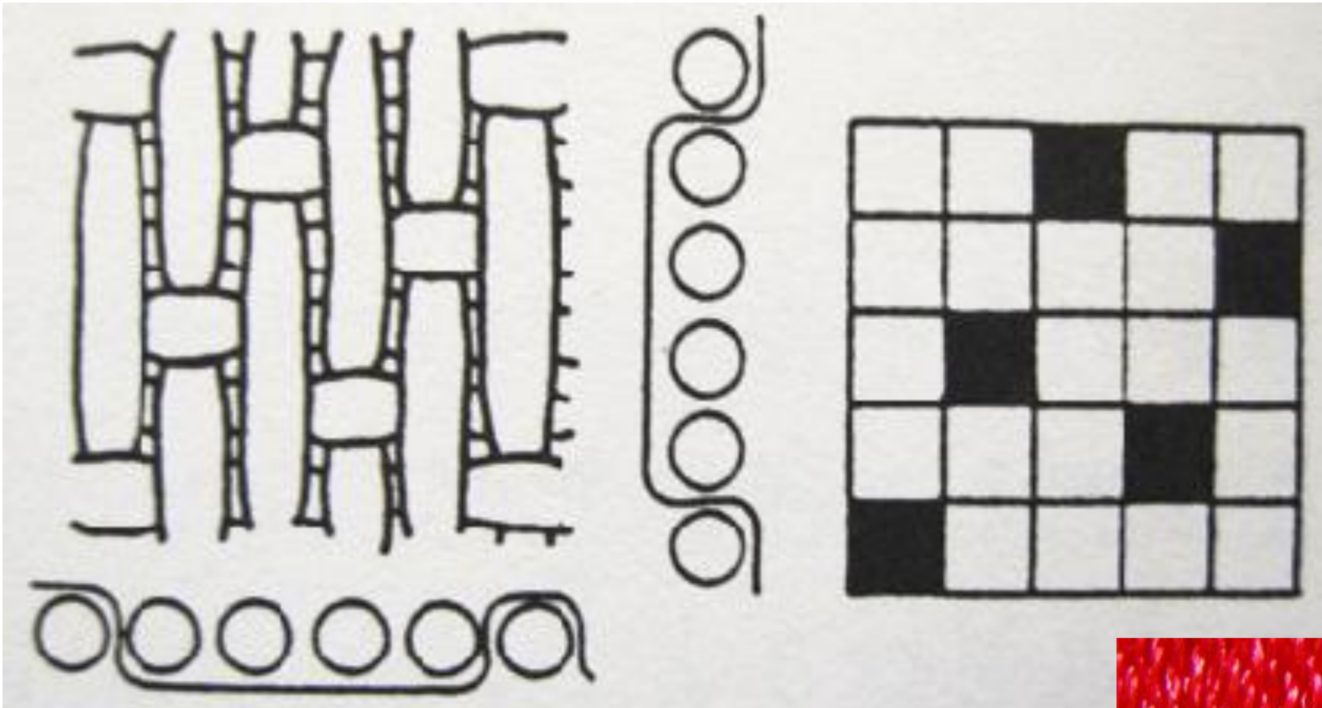
(c) Expanding period of accumulation layer of dust to whole area

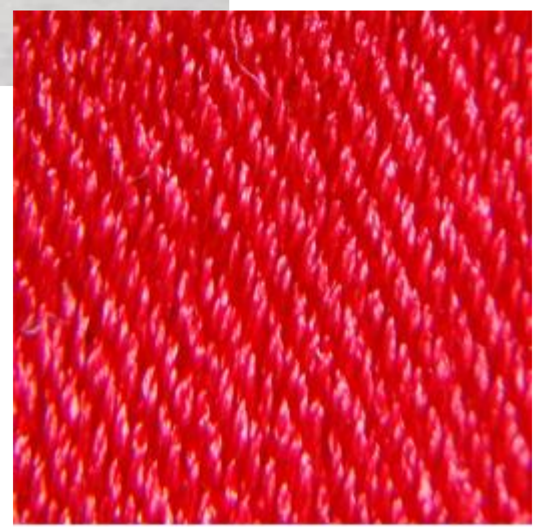
Examples of typical filter cloth of Bag filter

	Name	Weave	Fiber areal Weigh (g/m²)	Density (fiber/2.54cm) length	Density (fiber/2.54cm) width	Tensile strength (kg/cm²) length	Tensile strength (kg/cm²) width	Permeability ($cm^3 \cdot s^{-1} \cdot cm^{-2}$)	General thermal Resistance (℃)	Acid-resistance	Alkaline-resistance	Relative cost
Weave cloth	Cotton	5 fiber stain	325	75	57	80	57	5	60	×	△	1
	Pyrene	5 fiber stain	260	75	47	190	110	7	80	○	△	1.4
	Nylon	5 fiber stain	310	75	56	135	95	7	100	×	○	1.6
	Therm. Resist. Nylon	5 fiber stain	310	78	58	145	105	10	200	△	○	4.0
	Polyester	5 fiber stain	335	78	58	220	170	8	140	△	△	1.2
	Acrylic fiber	5 fiber stain	300	74	50	110	75	10	120	○	×	2.3
	Polytetrafluoro-ethylene (Teflon)	5 fiber stain	350	88	79	50	47	20	250	○	○	22.0
	Glass fiber	1/3 twill	480	48	20	185	130	20	250	○	○	3.3
	Glass fiber	original	790	48	40	288	120	15	250	○	○	5.4
	PPS*	5 fiber stain	300	100	50	180	95	6.2	190	○	○	6.5
		Surface processing		Thickness(mm)								
Non-weave cloth	Polyester	Shag burning	600	1.9		80	200	18	140	△	△	1.5
	Polyester	Membrane processing	550	1.8		70	140	5	140	△	△	10.0
	Pyrene	Shag burning	500	1.8		70	180	15	80	○	△	1.9
	Acrylic fiber	Shag burning	600	1.9		70	70	12	120	○	×	4.0
	Therm. Resist. Nylon	Shag burning	500	1.7		80	150	20	200	△	○	5.4
	Glass fiber	—	950	2.5		197	213	19	220	○	○	20.0
	Polytetrafluoro-ethylene (Teflon)	—	840	1.3		71	108	9	250	○	○	55.0
	PPS*	Smooth	550	1.7		70	140	15	190	○	○	8.0
	Tefire (Teflon)	—	710	1.3		60	50	15	250	○	○	21.0
	Polyimide	—	475	1.5		80	154	22	260	○	○	15.0

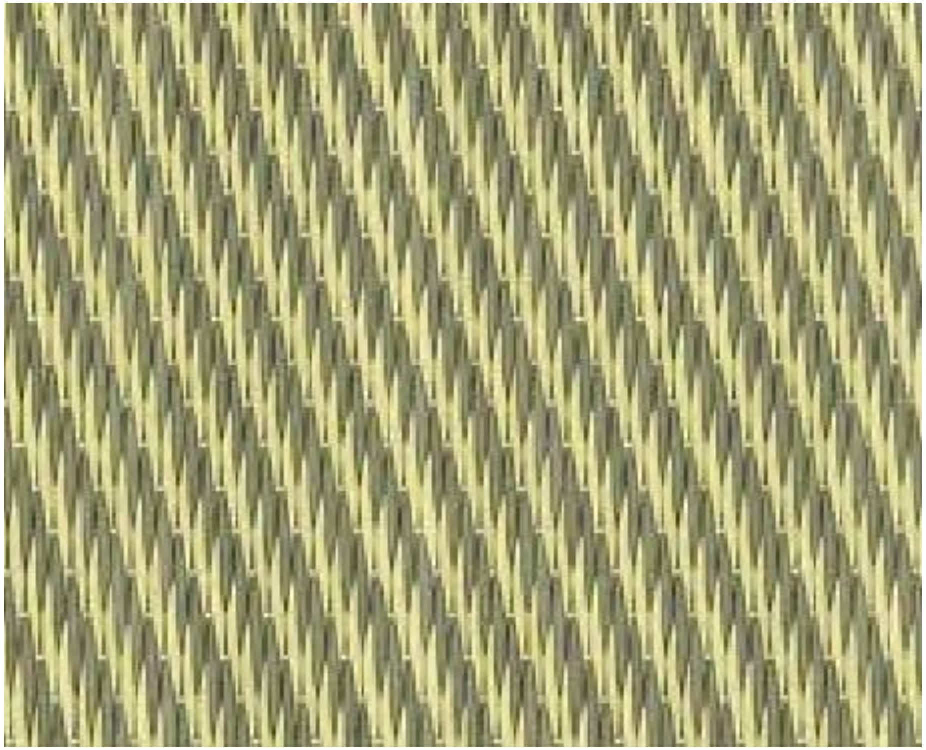
Pyrene : Polypropilene　　PPS *: Polyphenylenesulfide

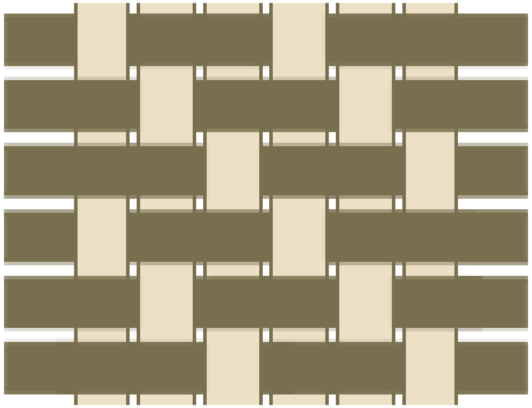
Satin weave



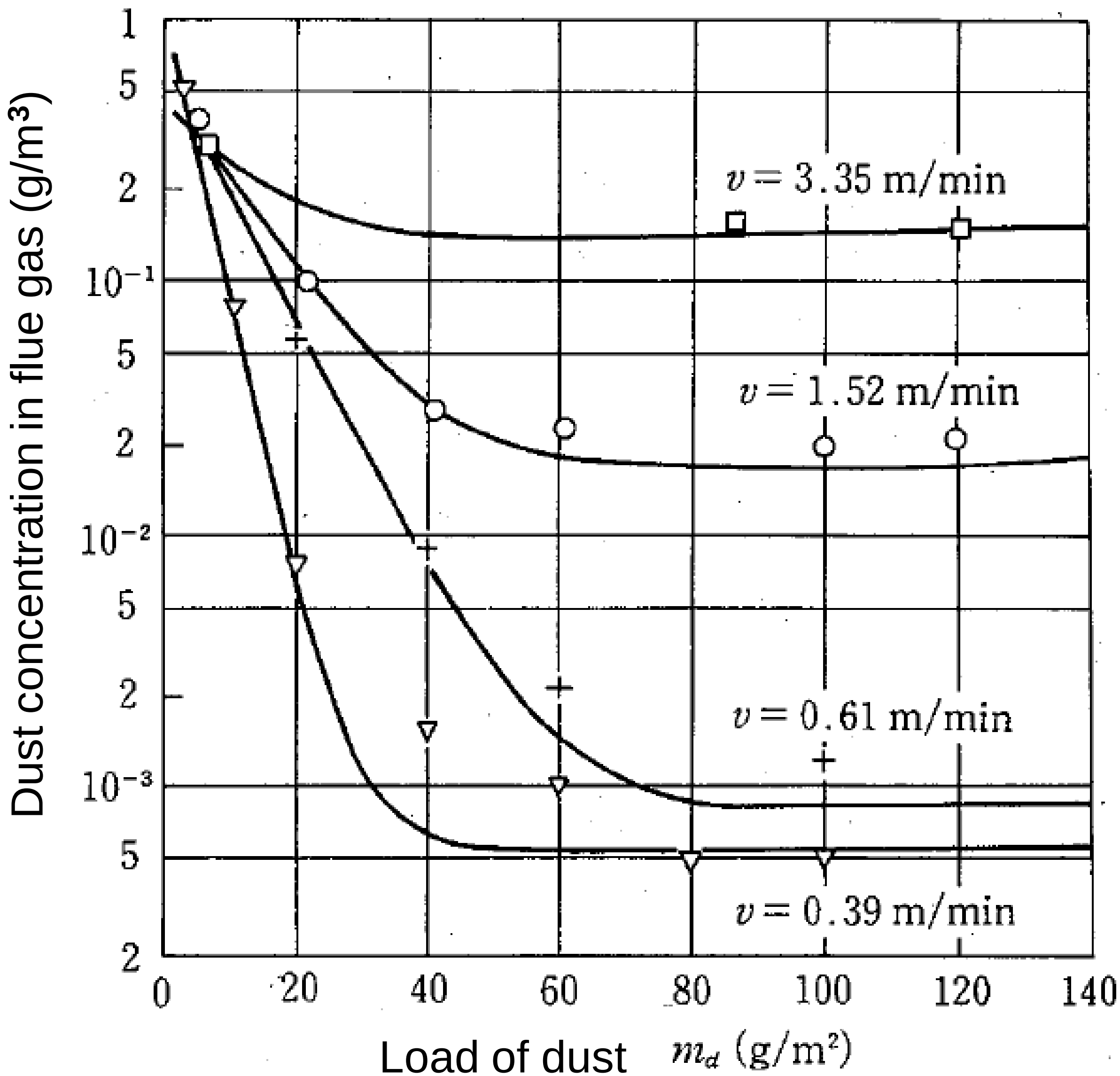


Twill weave

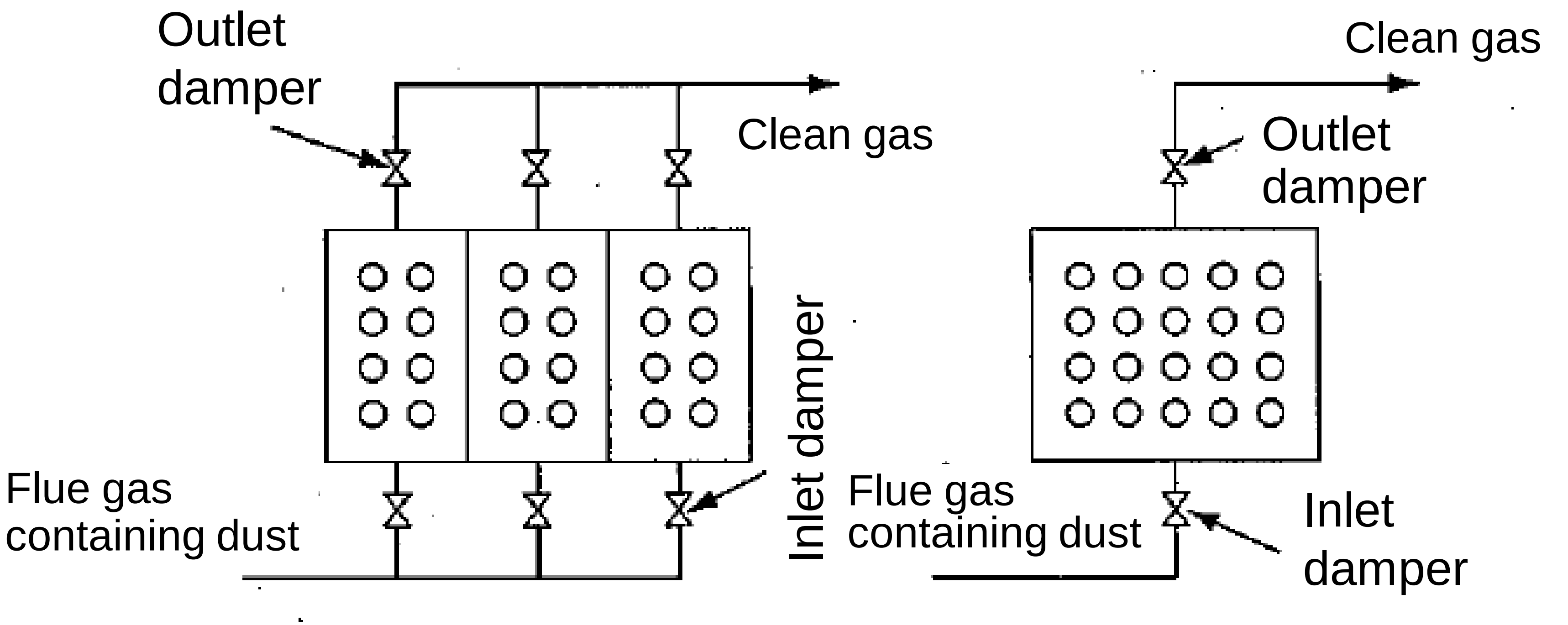




Efficiency change of collecting fly ash with bag filter made of glass fiber

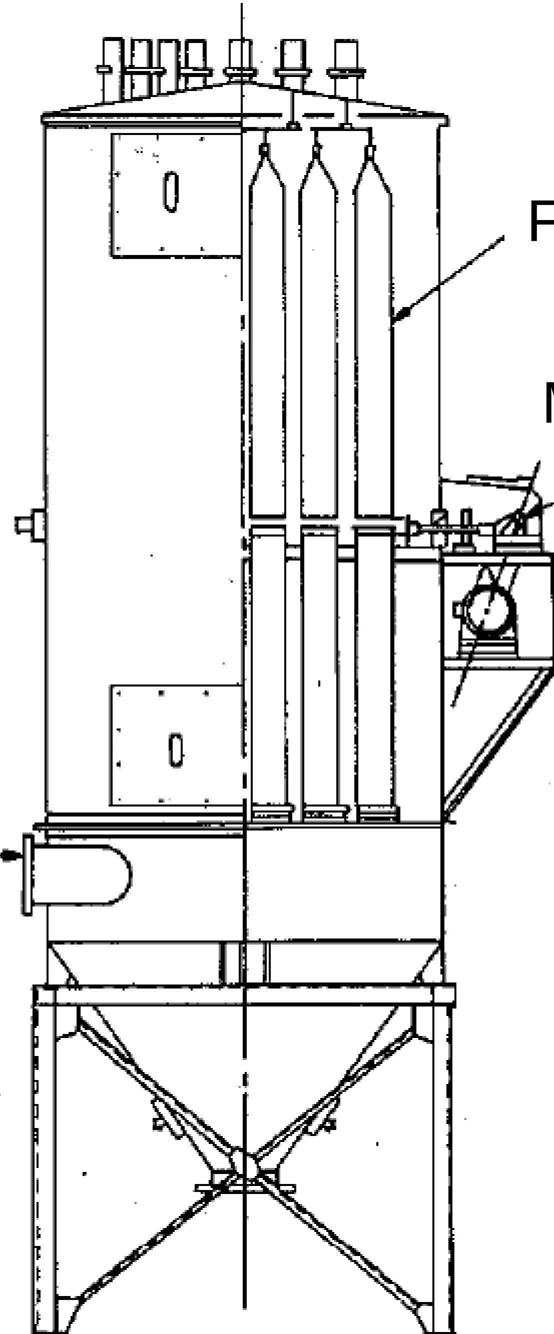


Removal methods of dust from bag filter

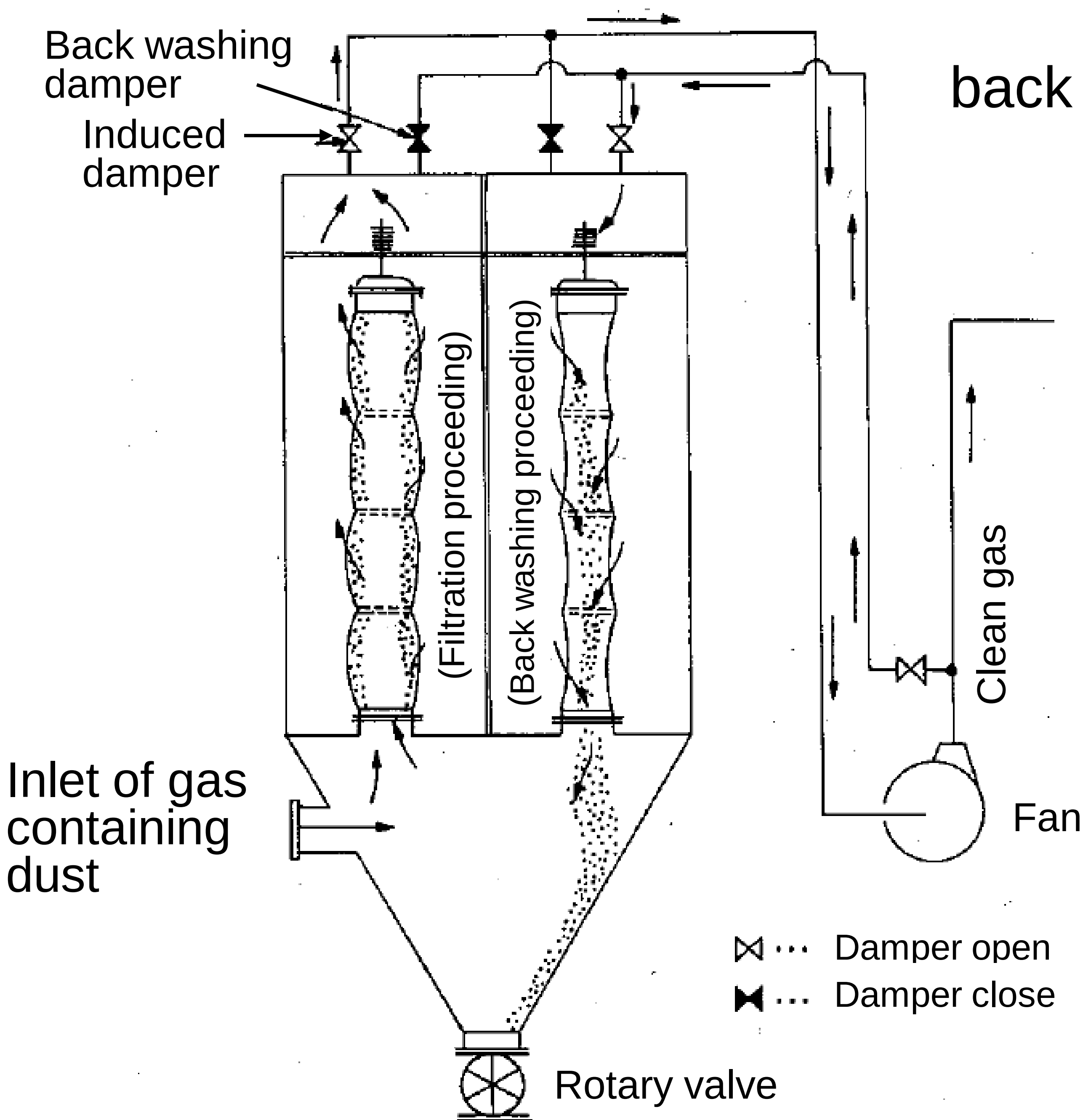


(a) Intermittent method (b) Continuous method

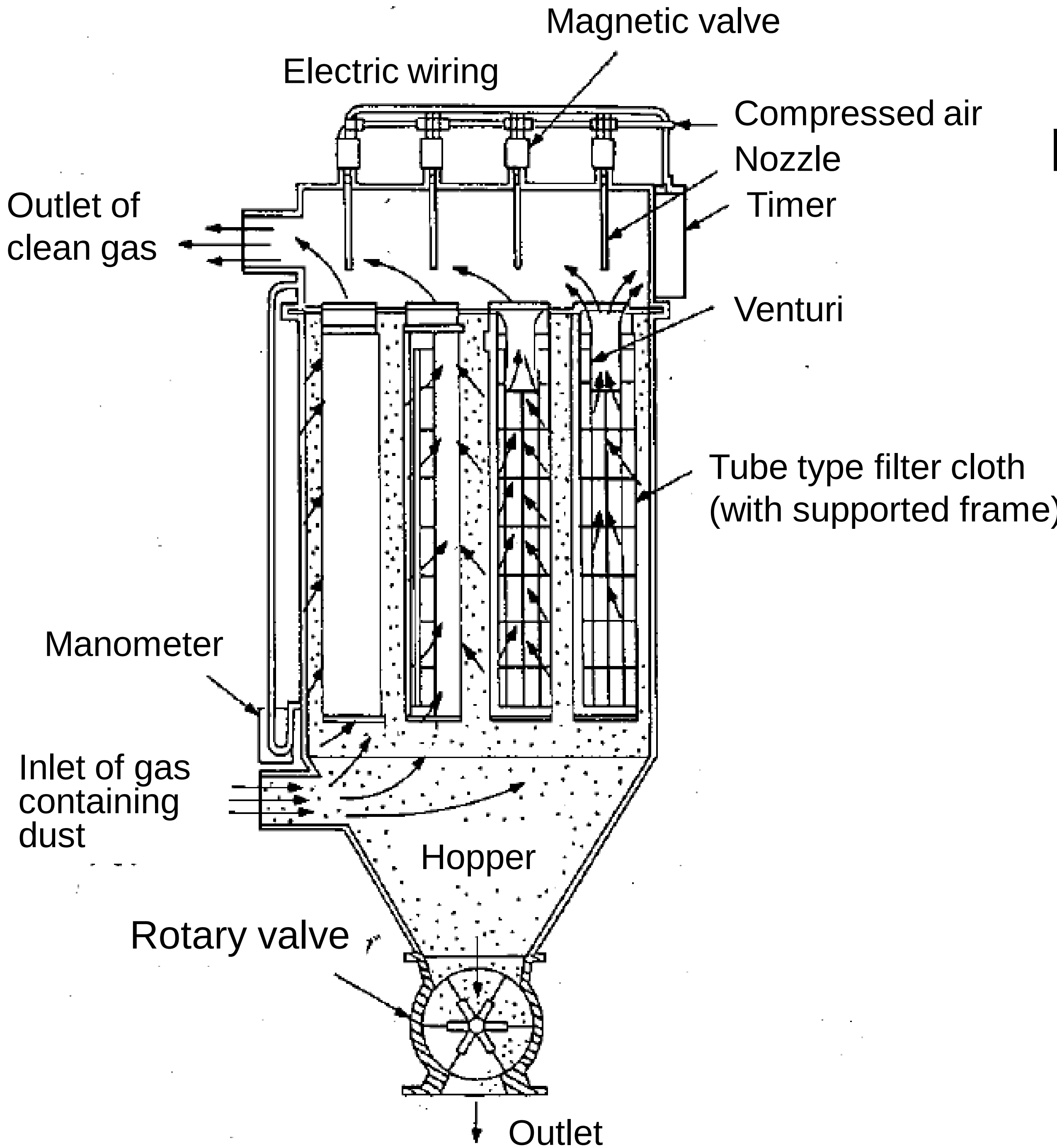
Example of vibration method（center vibration)



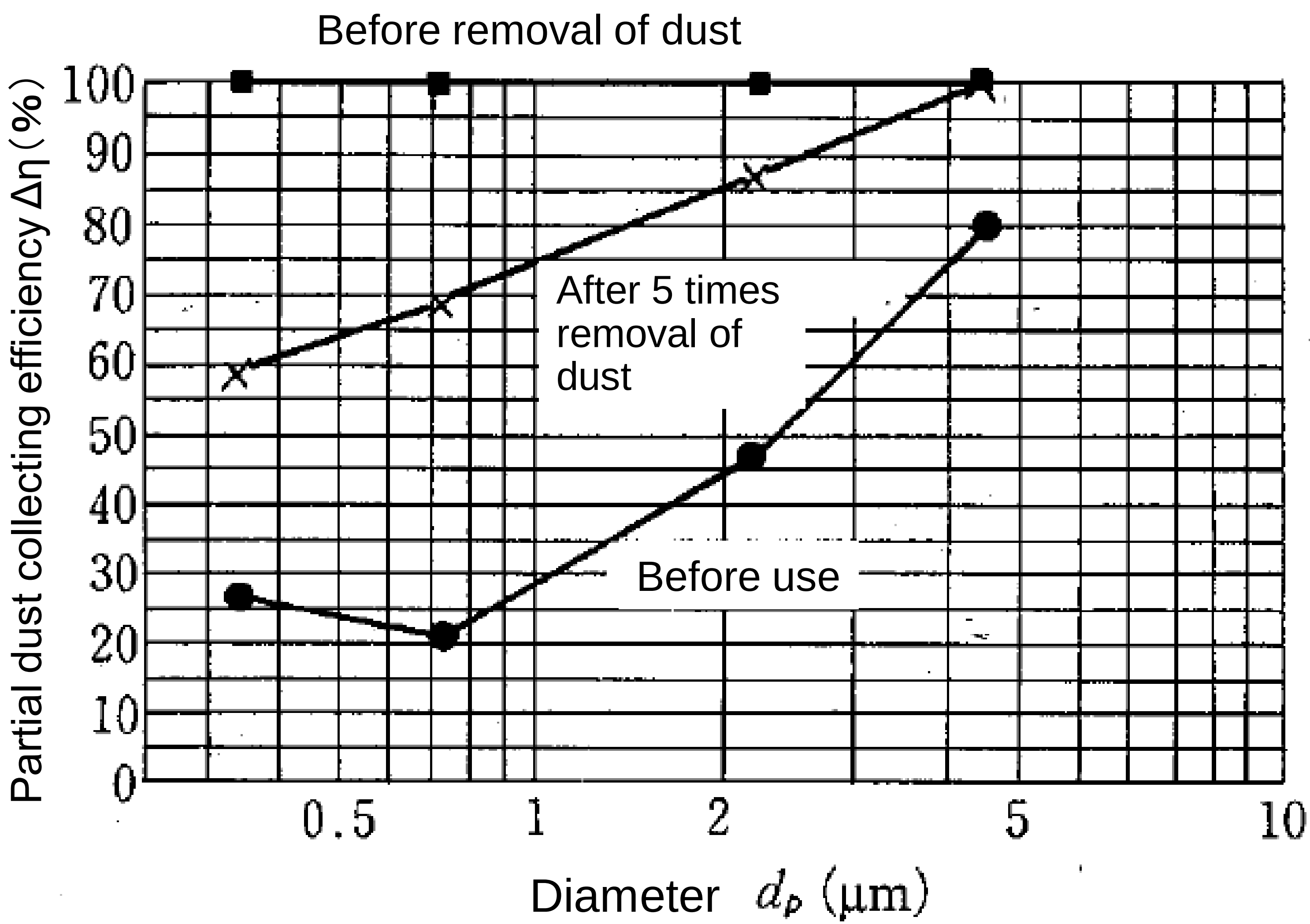
Example of back washing method



Example of plus jet method



Change of partial dust collecting efficiency



Classification and feature of bag filters (1/3)

Removal method of dust	Filter cloth			Filtration side	Filtration rate (m/min)	Applicable temperature (℃)	Feature and main use
	Type	Shape	Material				
Mechanical vibration	Woven fabric	Tube	Synthetic fiber such as Tetron	Inside	0.6～1.6	～200 (Heat resistant nylon)	Applicable from small gas volume to large and from general environmental dust to high temperature flue gas dust. Certain removal of dust and suitable for fume.
		Enve-lope		Out-side	1～2	～100	Small and easy dust collector Capacity several ten m^3/min

Classification and feature of bag filters (2/3)

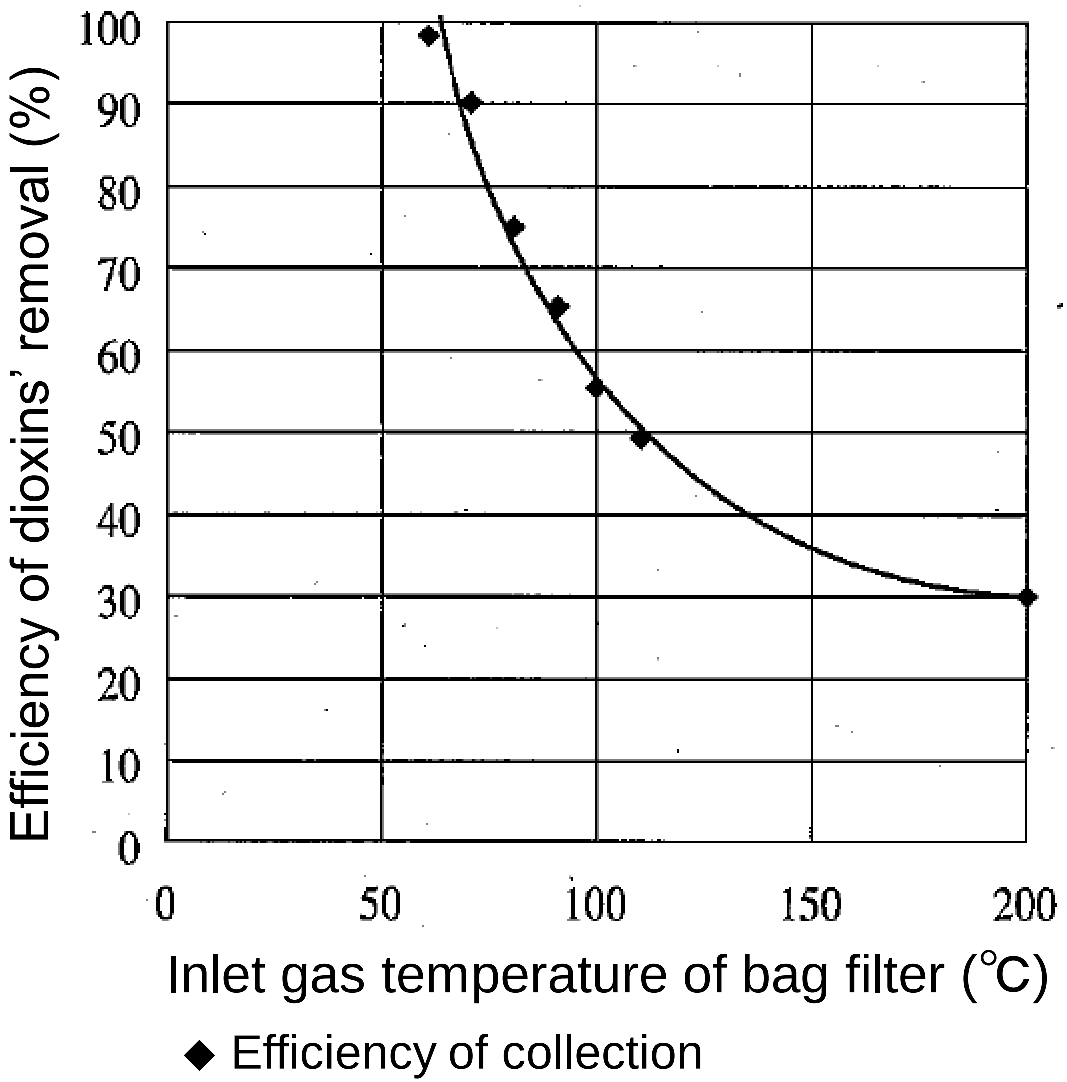
Removal method of dust	Filter cloth			Filtration side	Filtration rate (m/min)	Applicable temperature (℃)	Feature and main use
	Type	Shape	Material				
Mechanical pulse jet	Non-woven fabric	Tube and envelope	Synthetic fiber such as Tetron	Out-side	1~4	~200 (Heat resistant nylon)	Continuous dust removal is possible. Suitable for continuous operation of small volume flue gas. Suitable for high concentration and abrasive dust from such as pneumatic transportation. Compact body because of high filtration speed and can be installed at narrow space.
	Woven	Tube	Glass fiber		0.5~1.5	~250	Apply to high temp. flue gas from coal fired boiler
	Non-woven	Cartridge	Synthetic fiber or paper		0.3~1	~140 (Tetron)	Compact body with Large filtration area over machine body volume. High efficiency at even low dust concentration (suitable for such as air cleaner)
	Sintered compact	Tube	Metal fiber or ceramics		0.5~1.5	~450 ~1200	High temperature dust collection

Classification and feature of bag filters (3/3)

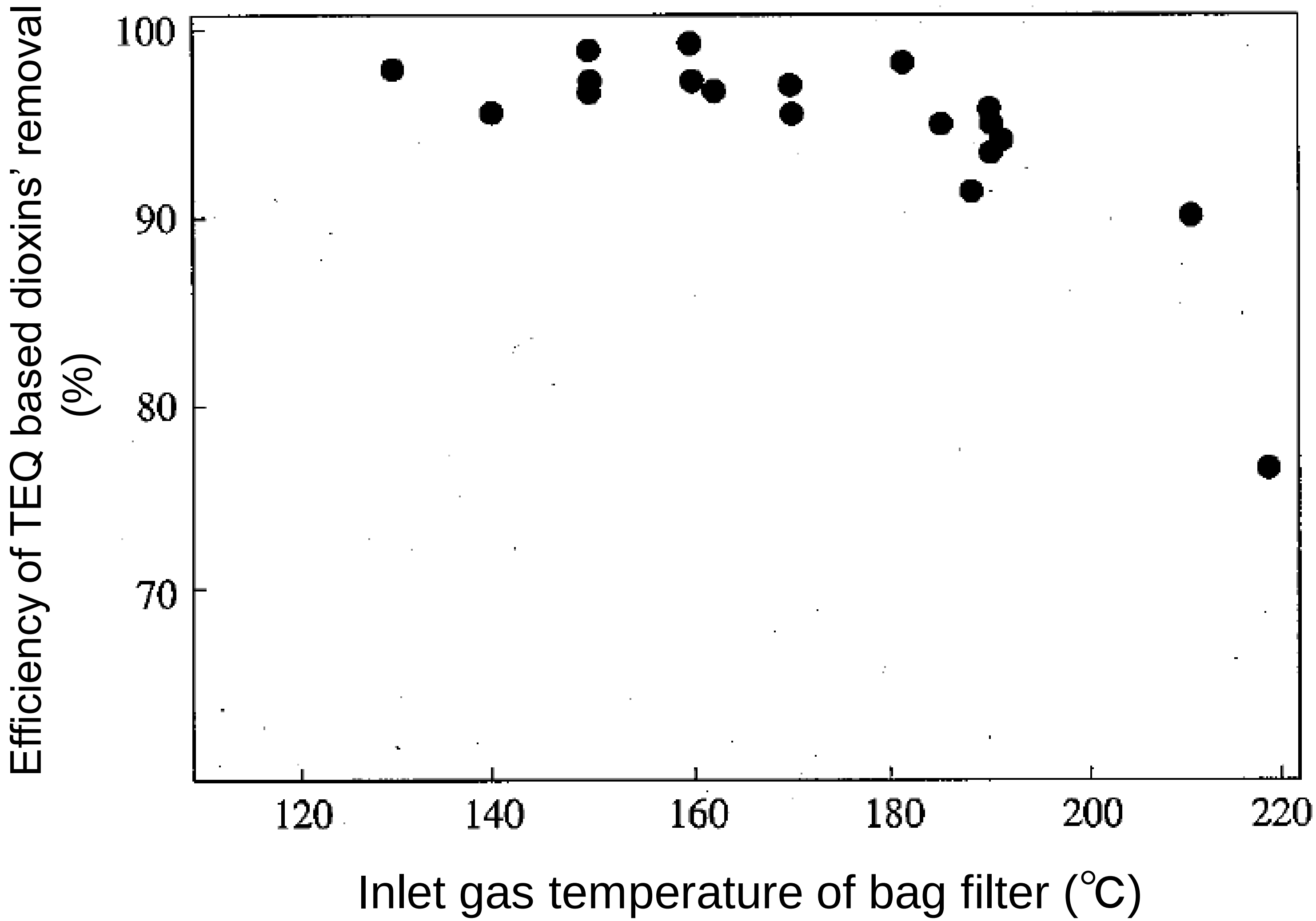
<table>
<tr><th rowspan="2">Removal method of dust</th><th colspan="3">Filter cloth</th><th rowspan="2">Filtration side</th><th rowspan="2">Filtration Rate (m/min)</th><th rowspan="2">Applicable temperature (℃)</th><th rowspan="2">Feature and main use</th></tr>
<tr><th>Type</th><th>Shape</th><th>Material</th></tr>
<tr><td rowspan="3">Back pressure or back washing</td><td rowspan="2">Woven or non-woven</td><td rowspan="2">Tube</td><td>Synthetic fiber such as Tetron</td><td rowspan="2">Inside</td><td>0.6～1.2</td><td>～200 (Heat resistant nylon)</td><td>Traditionally and widely used at cement mill and iron plant</td></tr>
<tr><td>Glass fiber</td><td>0.3～1</td><td>～250</td><td>Suitable for high temperature fume from carbon black and non-metal refinery</td></tr>
<tr><td>non-woven</td><td>Enve -lope</td><td>Synthetic fiber such as Tetron</td><td>Out-side</td><td>1～2</td><td>～140 (Tetron)</td><td>Compact body and can be installed at narrow space. Suitable for large volume and easy removal dust from treatment such as casting sand.</td></tr>
</table>

Contents

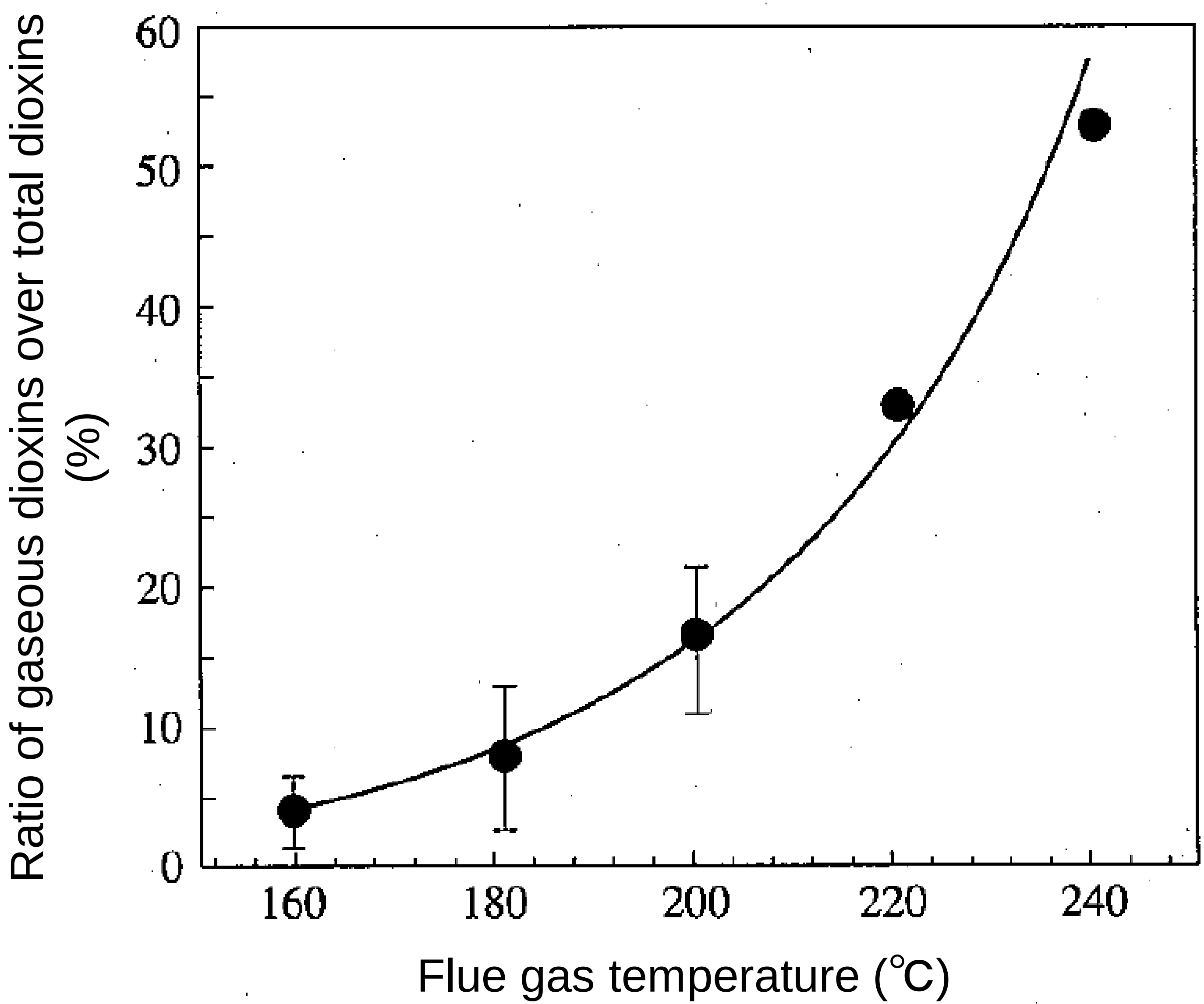
Relationship between inlet gas temperature of bag filter and efficiency of dioxins' removal



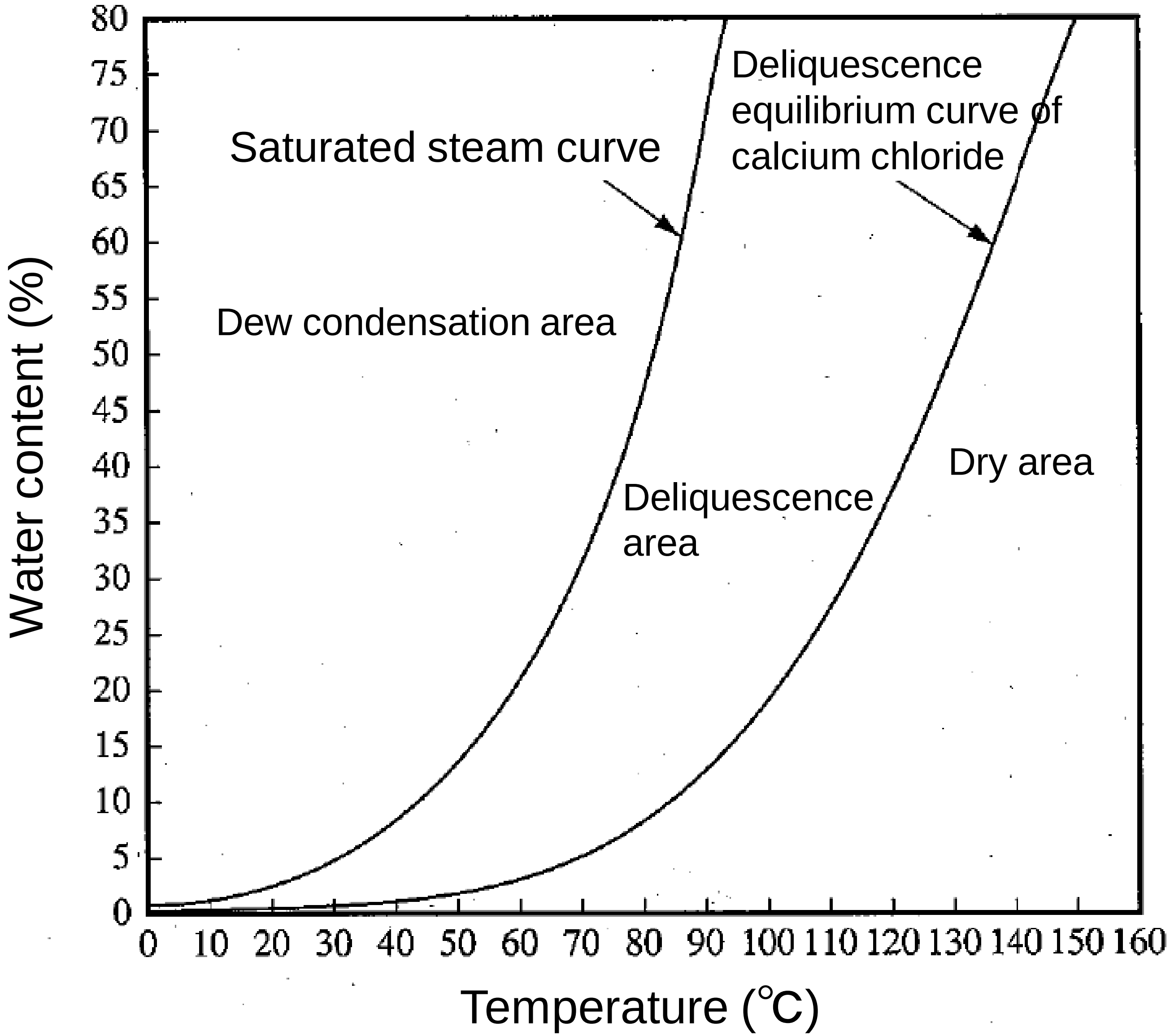
Relationship between efficiency of TEQ based dioxins' removal and inlet gas temperature of bag filter



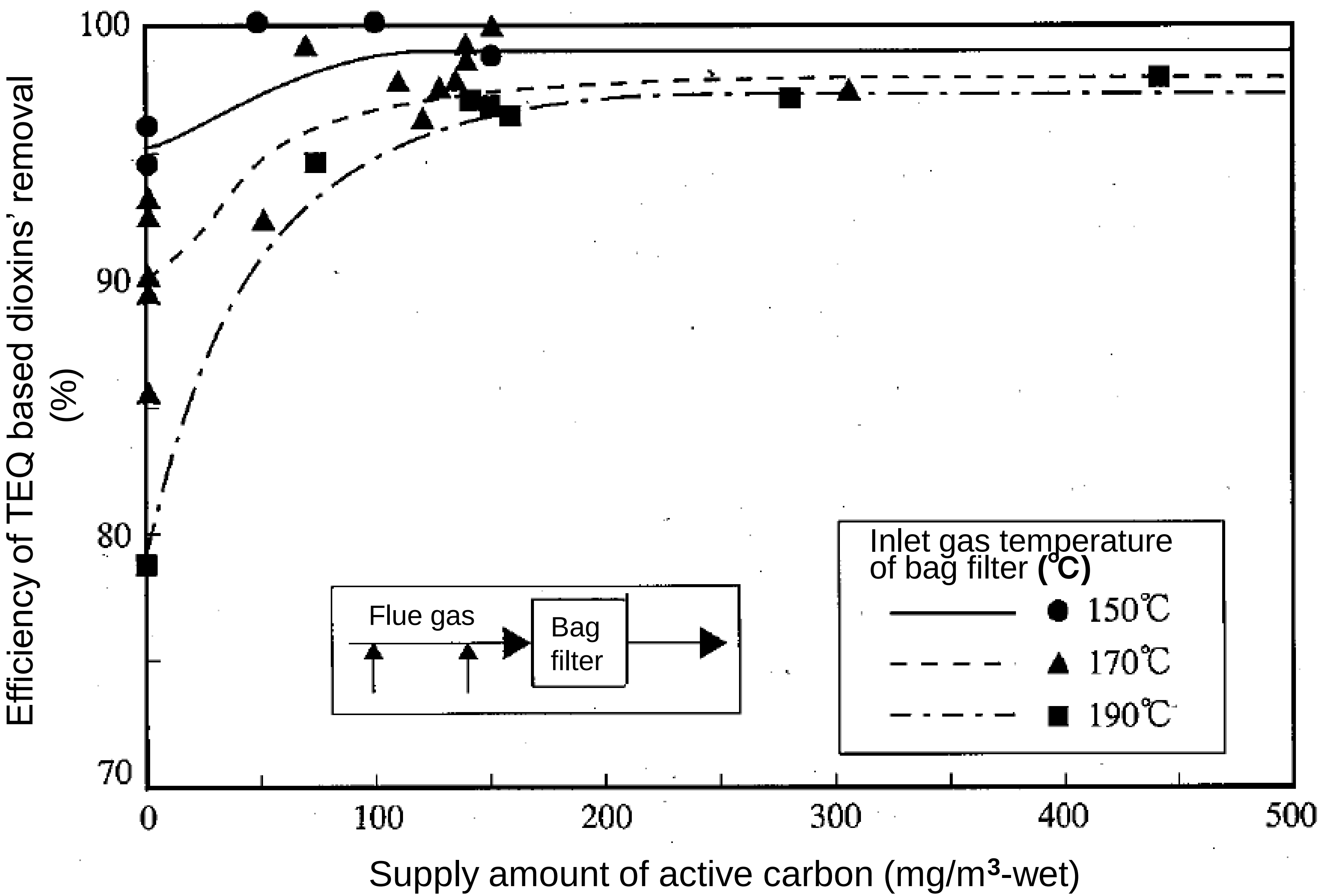
Relationship between gaseous dioxins' ratio and Flue gas temperature



Relationship between water content and deliquescence equilibrium curve of calcium chloride



Effect of Active carbon to remove dioxins with bag filter



Materials of activated carbon and their physical property for treatment of flue gas containing dioxins (1/3)

Materials			Pellet size and mean diameter and particle size distribution (mm)	Physical property					Manufacturer or seller
Type	Name	Raw materials		specific surface (m^2/g)	Accumulative pore volume (mL/g)	Adhesion of iodine (mg/g)	Apparent density (g/cm^3)	Technical analysis (wt%)	
Activated cokes	ダイアホープ ZS	Coal	9 (tube)	300	<1 nm : 0.06 1~2 nm : 0.02 <30 nm : 0.11	>300	>0.50	—	カルゴンカーボンジャパン(株)
	—	Coal	5 and 9 (Pellet)	170	<1 nm : 0.05 1~2 nm : 0.01 <30 nm : 0.10	—	—	—	JM 活性コークス(株)
Activated carbon	GL-50	Peat	<0.010 : 40 % <0.044 : 72 % <0.074 : 87 % <0.150 : 97 %	650	<1 nm : 0.25 1~50 nm : 0.23 0.1 nm~20μm : 1.1	700	0.49	Water : 3 Ash : 8	NORIT 社(オランダ), 栗田工業(株)
	GLS	Peat	<0.010 : 60 % <0.044 : 81 % <0.074 : 91 % <0.150 : 97 %	1150	0.82	1000	0.32	Loss on drying: 3 Ash : 10	
	クリコール KC-41	Wood	0.020	1050	0.24	1000	0.30	Loss on drying: 3 Ash : 10	栗田工業(株)
	クリコール KC-50	Lignite with alkaline	<0.045 : 95 % or more	490	0.44	540	0.34	Loss on drying: 8 or less	NORIT 社 (オランダ) 栗田工業(株)
	DARCO FGD	Lignite	<0.045 : 95 % or more	600	<1 nm : 0.18 1~25 nm : 0.25 25~75 nm : 1.06	600	0.51	Sulfur : 18	NORIT 社 (オランダ)

Materials of activated carbon and their physical property for treatment of flue gas containing dioxins (2/3)

Materials			Pellet size and mean diameter and particle size distribution (mm)	Physical property					Manufacturer or seller
Type	Name	Raw materials		specific surface (m^2/g)	Accumulative pore volume (mL/g)	Adhesion of iodine (mg/g)	Apparent density (g/cm^3)	Technical analysis (wt%)	
Activated carbon	ダイアホープ PXS	Coal	＜325 mash : 90 % or more	1100	＜1 nm : 0.21 1～2 nm : 0.21 ＜30 nm : 0.56	1060	0.30	volatile component : 14	カルゴンカーボンジャパン(株)
	ダイアホープ PXS	Coal	＜200 mash : 90 % or more	＞800	0.47	＞800	0.40	—	
	ダイアホープ ZX-4	Coal	3.00～4.75 : 95% or more	1100	＜1 nm : 0.15 1～2 nm : 0.21 ＜30 nm : 0.56	—	＜0.55	—	
	ダイアホープ PXE	Coal	＜200 mesh : 90 % or more	＞800	—	＞800	0.25～0.55	—	
	5AP-2	Coal	Mean diameter : 0.005～0.010 ＜0.045 : 90 % or more	1000	＜50 nm : 0.63	900	0.25～0.35	Water : 5 or less Ash : 8 or less	荏原エンジニアリングサービス(株)
	AG-400X	Coal	2.36～4.75 (tube) 90 % or more	1000	—	900	0.45～0.55	Water : 5 or less Ash : 8 or less	
	CLP	Coconut shell	0.0225	1120	0～1 nm : 0.24 1～5 nm : 0.04 5～10 nm : 0.01 10～15 nm : 0.03 Total pore volume : 0.32	980	0.43	—	フタムラ化学(株)

Materials of activated carbon and their physical property for treatment of flue gas containing dioxins (3/3)

Materials			Pellet size and mean diameter and particle size distribution (mm)	Physical property					Manufacturer or seller
Type	Name	Raw materials		specific surface (m^2/g)	Accumulative pore volume (mL/g)	Adhesion of iodine (mg/g)	Apparent density (g/cm^3)	Technical analysis (wt%)	
Activated carbon	GLP	Coal	0.0202	1040	0~1 nm : 0.18 1~5 nm : 0.20 5~10 nm : 0.06 10~15 nm : 0.11 Total pore volume : 0.55	950	0.41	—	フタムラ化学(株)
	白鷺 DO-2	Coconut shell	(Power)	1030	0.45	1080	0.300	—	日本エンバイロケミカルズ(株)
	白鷺 DO-5	Coal	(Power)	1020	0.52	950	0.320	—	
	白鷺 DO-11	Wood	(Power)	820	0.44	900	0.250	—	

Examples of effect of activated carbon applied to waste gas treatment of waste incinerator (1/3)

No.	Source of flue gas and equipment	Waste gas volume (m^3_N/h)	Materials	Temp. (℃)	SV (h^{-1})	Removal of dioxins			
						Inlet conc.	Outlet conc.	Removal (%)	Remarks
1	Large pilot plant with adsorber using real flue gas	1800 3600	Activated cokes (Pellet : 4.5mmφ× 6～7mmL)	150	1105 2210	36 ng/m^3_N (0.55 ng-TEQ/m^3_N) 31 ng/m^3_N (0.5 ng-TEQ/m^3_N)	0.69 ng/m^3_N (0.001 ng-TEQ/m^3_N) 1.4 ng/m^3_N (0.029 ng-TEQ/m^3_N)	99.8 94.2	—
2	Adsorber using flue gas from stoker furnace	70	Activated carbon (Pellet : 3mmφ× 4mmL)	150	320 640 970	0.34 ng-TEQ/m^3_N 0.20 ng-TEQ/m^3_N 0.23 ng-TEQ/m^3_N	0.052 ng-TEQ/m^3_N 0.025 ng-TEQ/m^3_N 0.0058 ng-TEQ/m^3_N	85 88 97	After 2308 hr
3	Small adsorber using flue gas from stoker furnace	11	Activated carbon (6.2～70.mmφ, specific surface 800 m²/g, pore volume 0.43mL/g	170	4400 13000	0.3～4ng-TEQ/m^3_N	<0.05 ng-TEQ/m^3_N	97 (SV13000)	After 3600 hr
4	Adsorber using flue gas from floating bed waste furnace	16000～ 19000	Activated carbon (grains)	143 147	—	2.1 ng-TEQ/m^3_N 1.6 ng-TEQ/m^3_N	0.02 ng-TEQ/m^3_N <0.016 ng-TEQ/m^3_N	99.0 >99.0	After 3040 hr 3960 hr
5	Adsorber after bag filter using flue gas from floating bed continual burning furnace	9100～ 11500	Activated carbon (grains)	140 (outlet)～ 150 (inlet)	500	18 ng-TEQ/m^3_N 8.2 ng-TEQ/m^3_N	0.016 ng-TEQ/m^3_N <0.016 ng-TEQ/m^3_N	99.9 >99.8	After 3500 hr 4500hr
6	Spray injection of adsorbent into flue of small industrial waste furnace	5000～ 5700	Powder activated cokes & powder charcoal (20mmφ, specific surface 300～775 m²/g, pore volume 0.62～0.95mL/g	189～208 (Inlet of Bag filter)	—	0.23～0.27 ng-TEQ/m^3_N	0.018～0.046 ng-TEQ/m^3_N	80.3～92.5	Absorbent : 74～82 mg/m^3_N (dry)
7	Spray injection of adsorbent into diverged flue line of real furnace	1000	Powder charcoal (20～30μmφ, specific surface 1050 m²/g, pore volume 0.53mL/g	150 180 210	—	45 ng-TEQ/m^3_N 28 ng-TEQ/m^3_N 24 ng-TEQ/m^3_N	<0.00 ng-TEQ/m^3_N <0.00 ng-TEQ/m^3_N 0.03 ng-TEQ/m^3_N	>99.9 >99.9 99.9	—

Examples of effect of activated carbon applied to waste gas treatment of waste incinerator (2/3)

No.	Source of flue gas and equipment	Waste gas volume (m^3_N/h)	Materials	Temp. (℃)	SV (h^{-1})	Removal of dioxins			
						Inlet conc.	Outlet conc.	Removal (%)	Remarks
8	Stoker furnace (350t/d), Real flue gas (Bag filter → Wet washing tower of flue gas → Activated carbon adsorber → Catalytic denitrification tower)	—	Activated carbon	—	—	Dioxins 23 ng/m^3_N (0.41 $ng\text{-}TEQ/m^3_N$) Chlorobenzenes 650 ng/m^3_N Chlorophenols 400 ng/m^3_N	Dioxins 0.21 ng/m^3_N (0.00032 $ng\text{-}TEQ/m^3_N$) Chlorobenzenes 14 ng/m^3_N Chlorophenols ND	Dioxins : 99.1 (TEQ 99.9) Chlorobenzenes : 97.8, Chlorophenols : ≒100	—
9	Spray injection of adsorbent into flue of industrial waste furnace	—	Activated carbon (specific surface 410 ㎡/g, pore volume 0.336 mL/g), Activated cokes (specific surface 52 ㎡/g, pore volume 0.036 mL/g	—	—	Activated carbon 3.62 $ng\text{-}TEQ/m^3_N$ Activated cokes 6.12~6.95 $ng\text{-}TEQ/m^3_N$	Activated carbon 0.84 $ng\text{-}TEQ/m^3_N$ Activated cokes 1.29~1.42 $ng\text{-}TEQ/m^3_N$	Activated carbon 76.8 Activated cokes 78.9～79.5	—
10	Spray injection of adsorbent into flue of stoker furnace (with bag filter)	—	Activated carbon	—	—	0.18 $ng\text{-}TEQ/m^3_N$	0.00015 $ng\text{-}TEQ/m^3_N$	99.9	—
11	Spray injection of adsorbent into flue of stoker furnace and electrical ash melting furnace (plasma type)(with bag filter and catalytic reactor)	—	Activated carbon	<200	—	1.5 $ng\text{-}TEQ/m^3_N$	0.00019 $ng\text{-}TEQ/m^3_N$	≈100	—
12	Spray injection of adsorbent into flue of stoker furnace (with bag filter)	—	Activated carbon	161～176	—	5.1 $ng\text{-}TEQ/m^3_N$	0.029 $ng\text{-}TEQ/m^3_N$	99.4	—
13	Spray injection of adsorbent into flue of stoker furnace (with bag filter)	—	Activated carbon	170	—	1.5 $ng\text{-}TEQ/m^3_N$	0.19 $ng\text{-}TEQ/m^3_N$	87	—

Examples of effect of activated carbon applied to waste gas treatment of waste incinerator (3/3)

No.	Source of flue gas and equipment	Waste gas volume (m^3_N/h)	Materials	Temp. (℃)	SV (h^{-1})	Removal of dioxins			
						Inlet conc.	Outlet conc.	Removal (%)	Remarks
14	Spray injection of adsorbent into flue of floating bed ash gasification & melting furnace (one tower type) (with bag filter and catalytic reactor)		Activated carbon	150	—	—	0.00033~0.0015 ng-TEQ/m^3_N	—	—
15	Spray injection of adsorbent into flue of stoker furnace (with bag filter)	—	Activated carbon	160	—	—	0.012 ng-TEQ/m^3_N	—	—

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7. Produced inhibition of Dioxins
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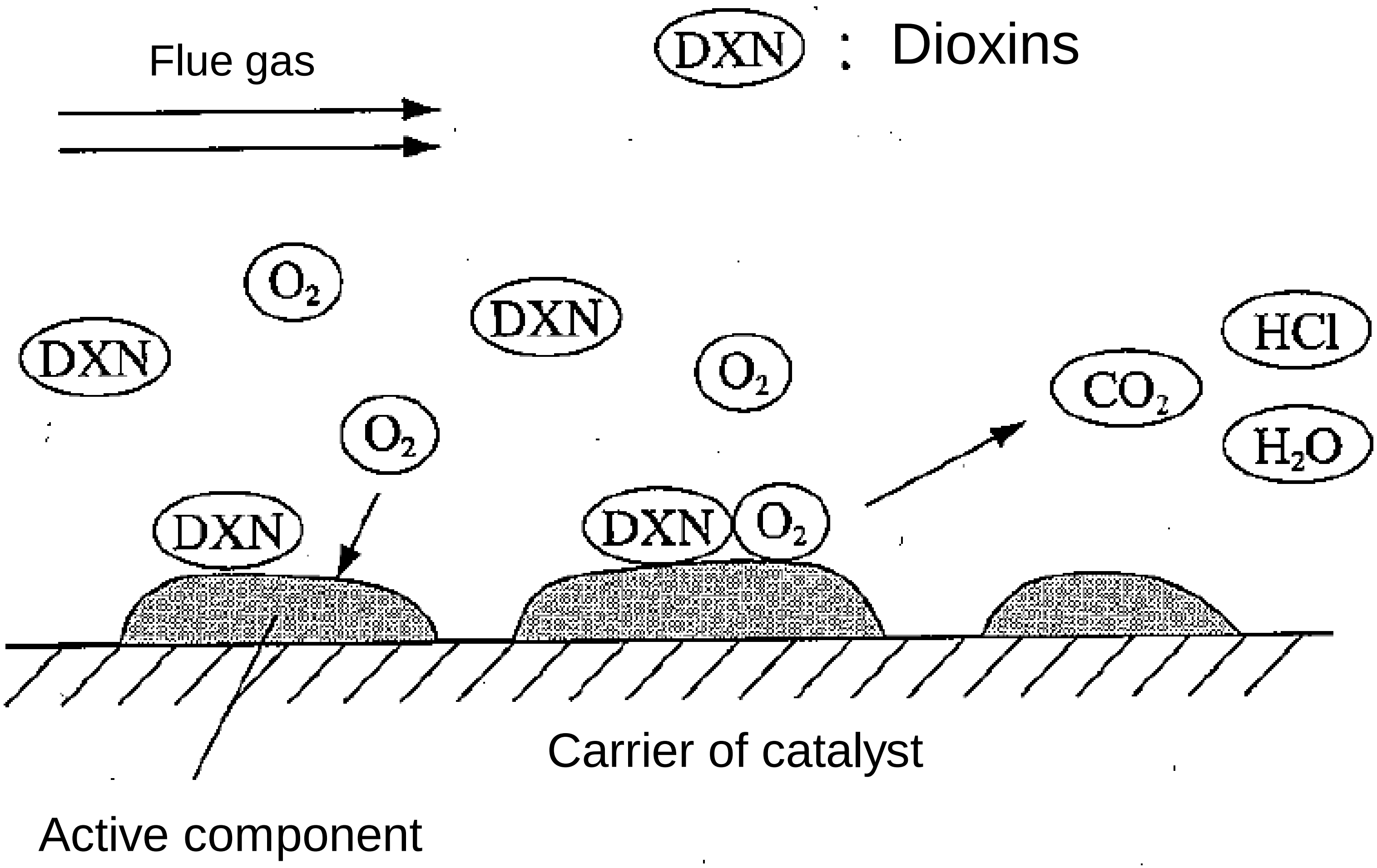
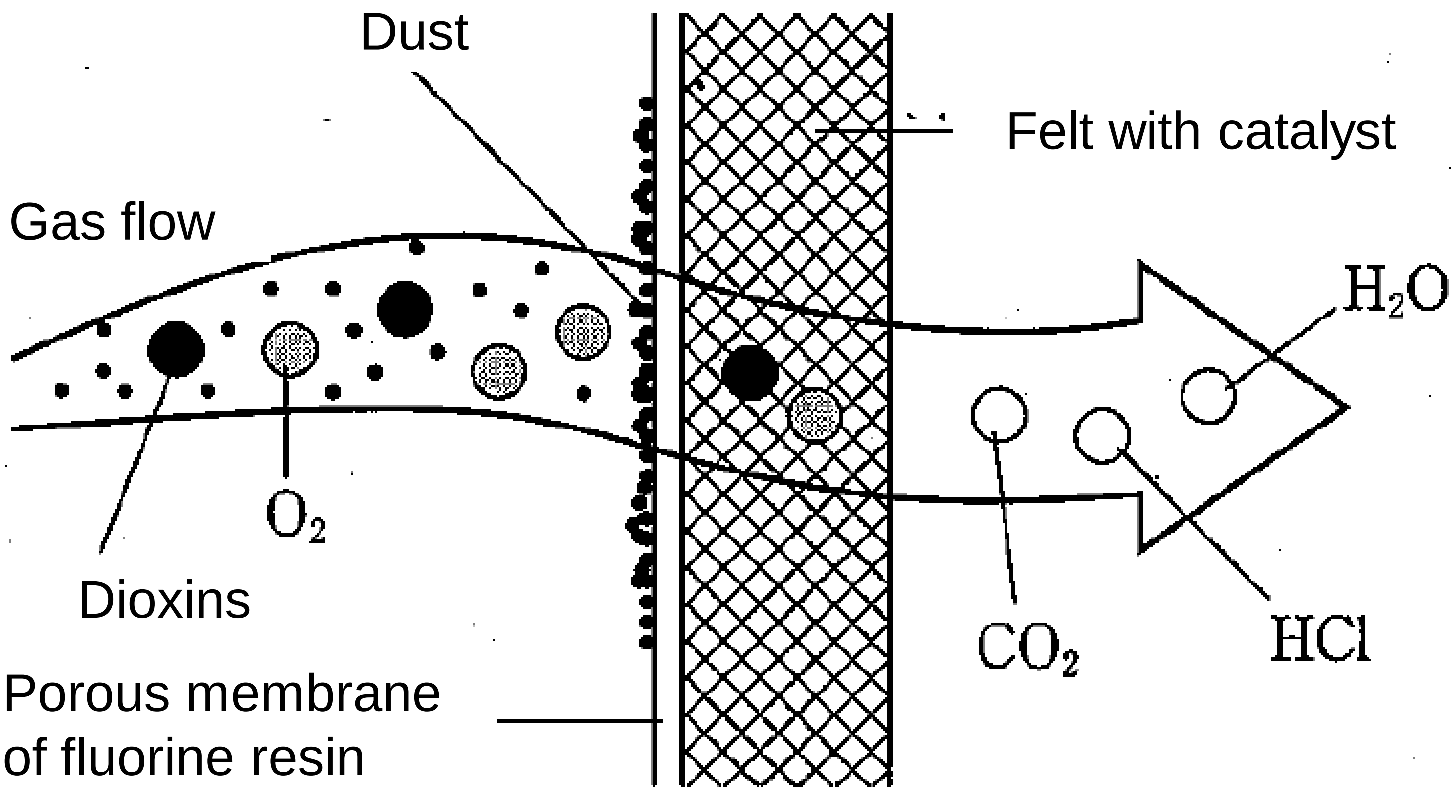
9. Decomposition technologies of materials containing Dioxins

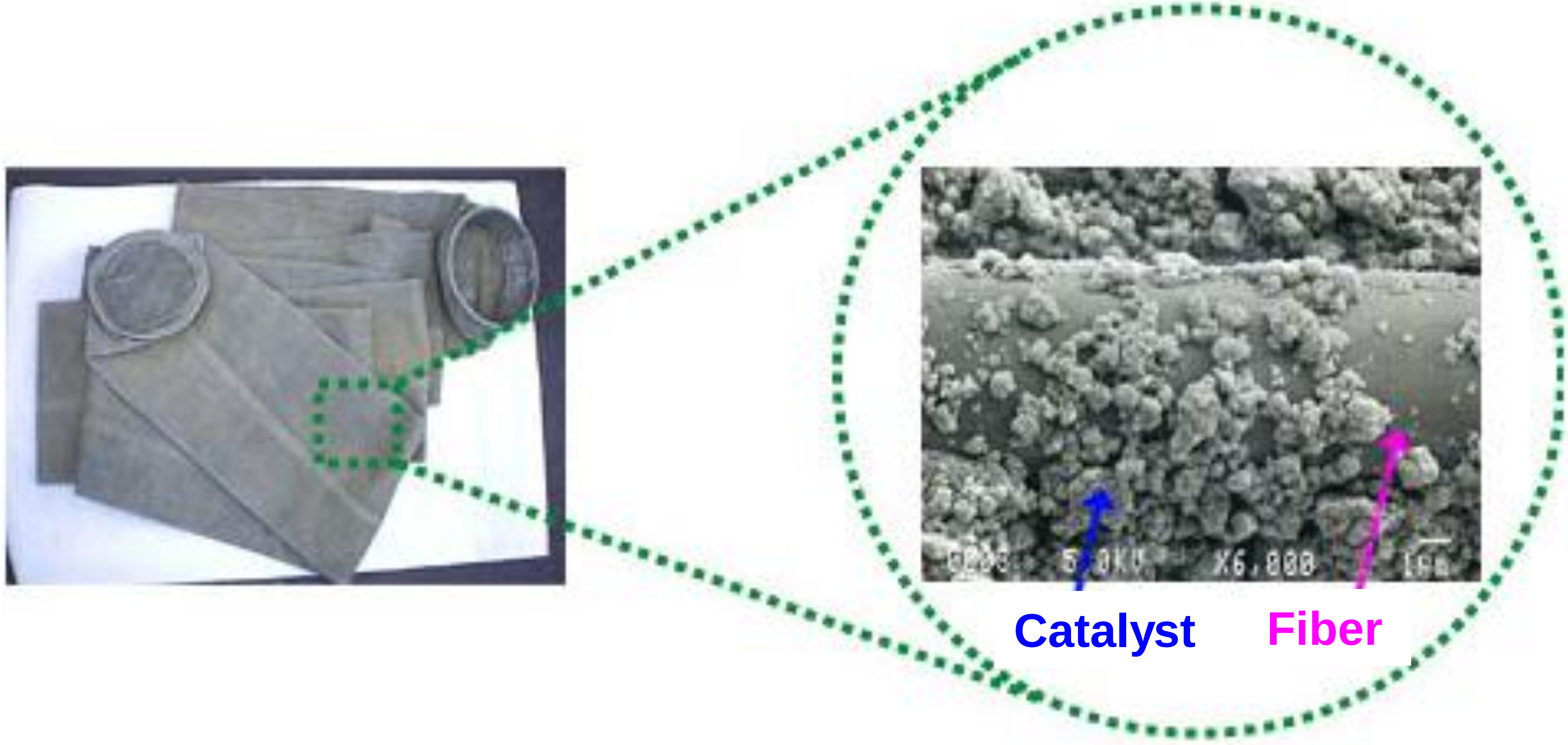
Schematic drawing of catalytic decomposition of dioxins



Structure and function of catalytic bag filter

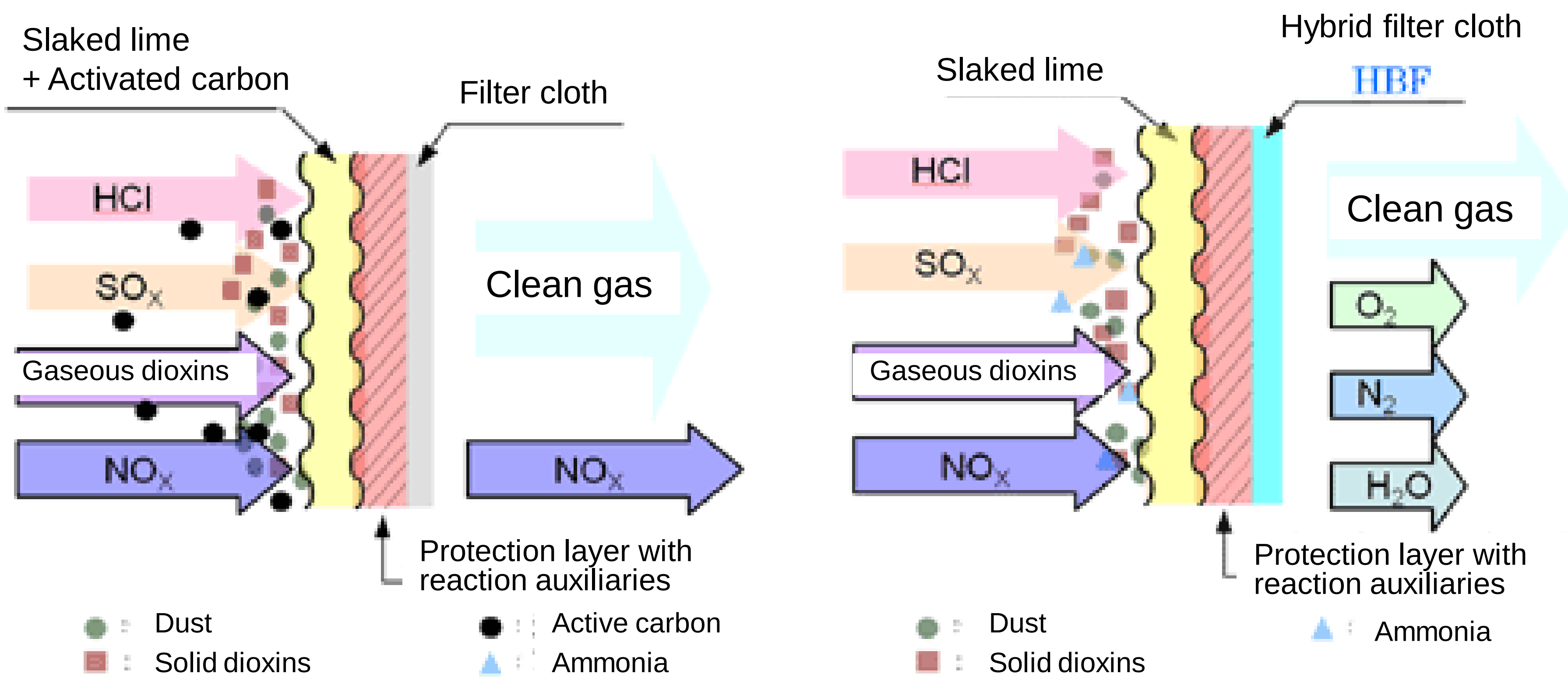


Picture of catalytic bag filter



Source : HP of Mitsubishi heavy industries environmental and chemical engineering co., Ltd

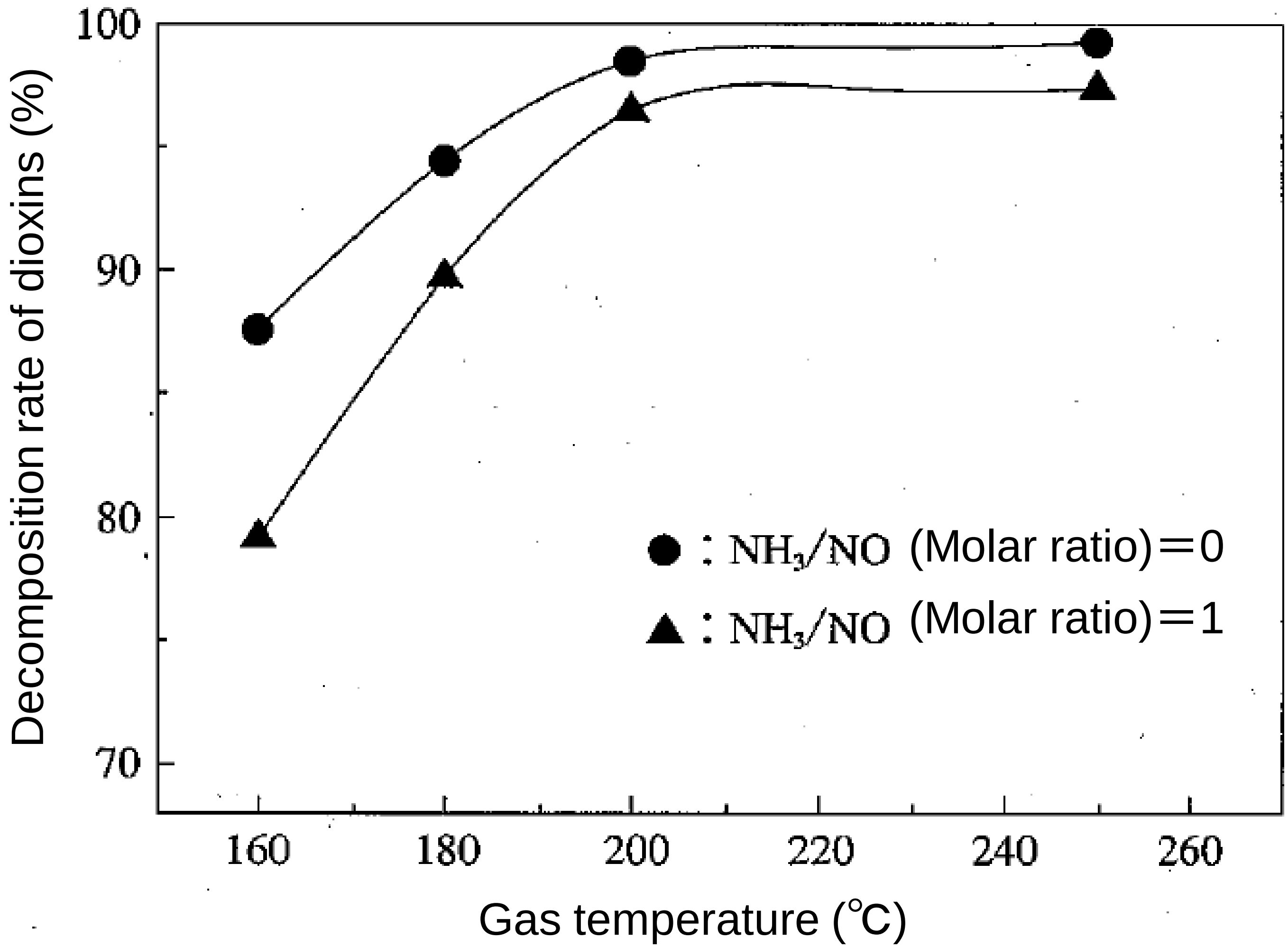
Example of high performance catalytic bag filter



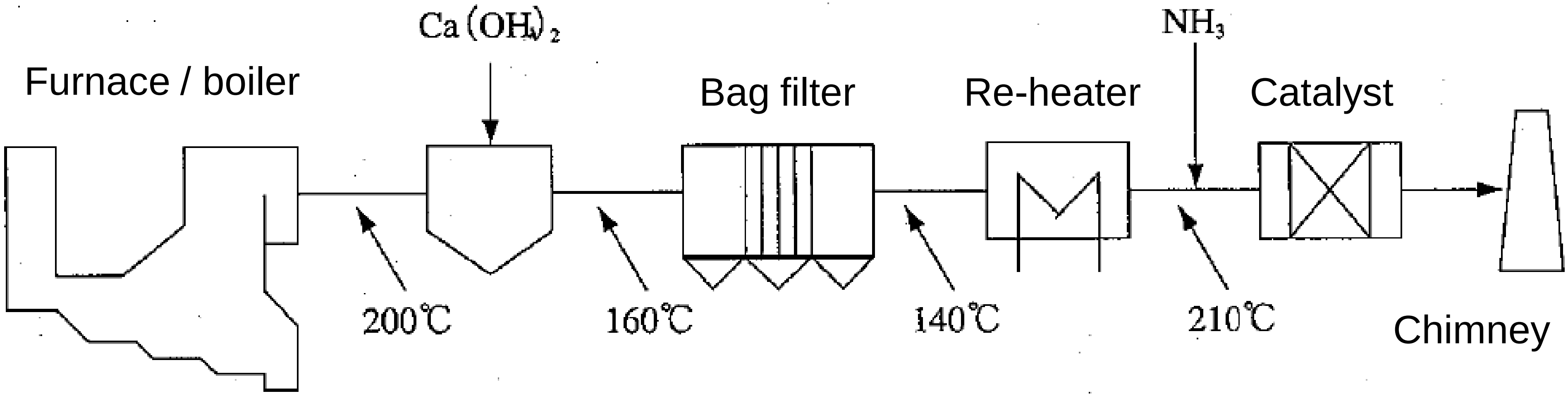
Traditional cleaning mechanism of flue gas with bag filter

New cleaning mechanism of flue gas with hybrid bag filter

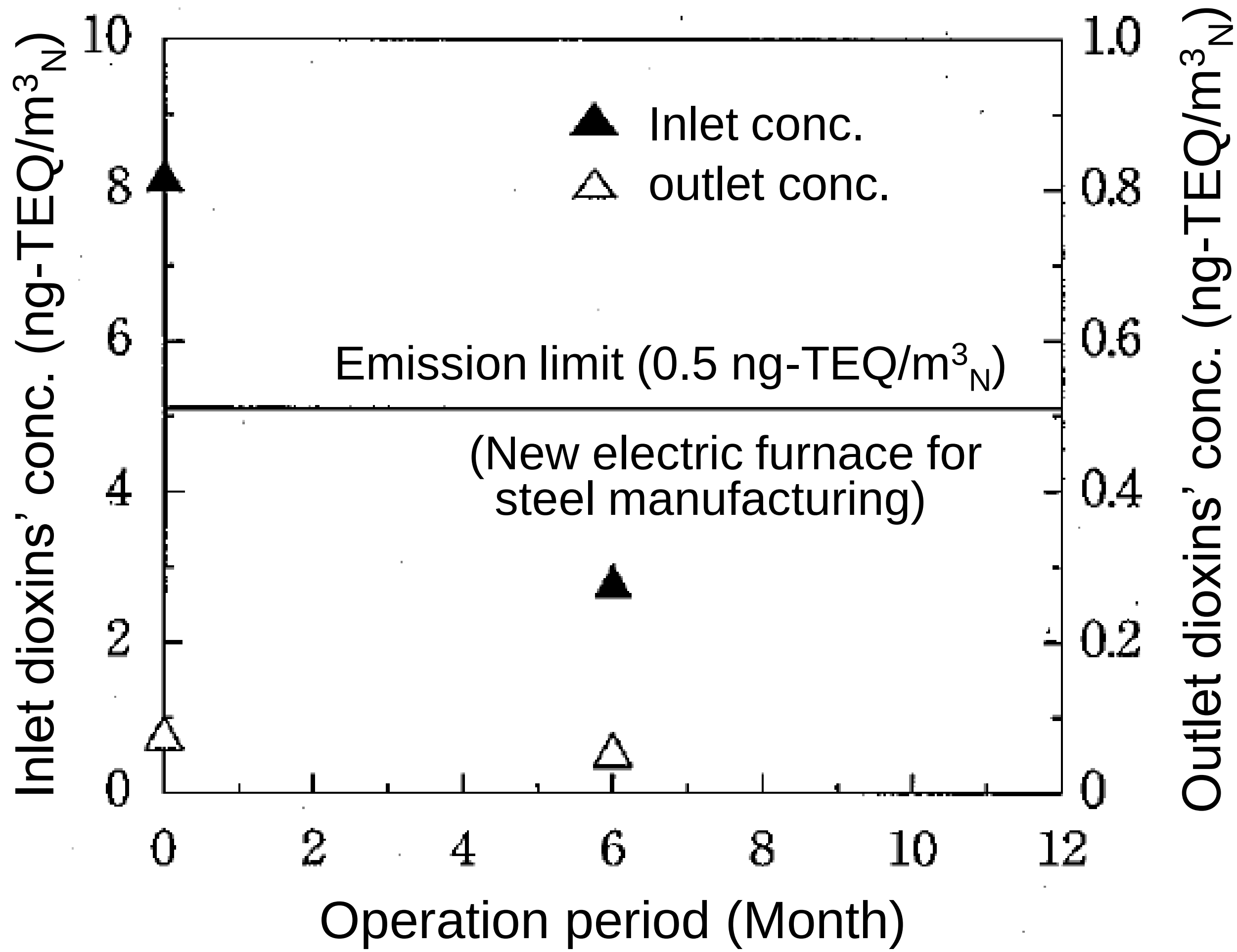
Oxidation decomposition of dioxins in flue gas with vanadium oxide catalyst



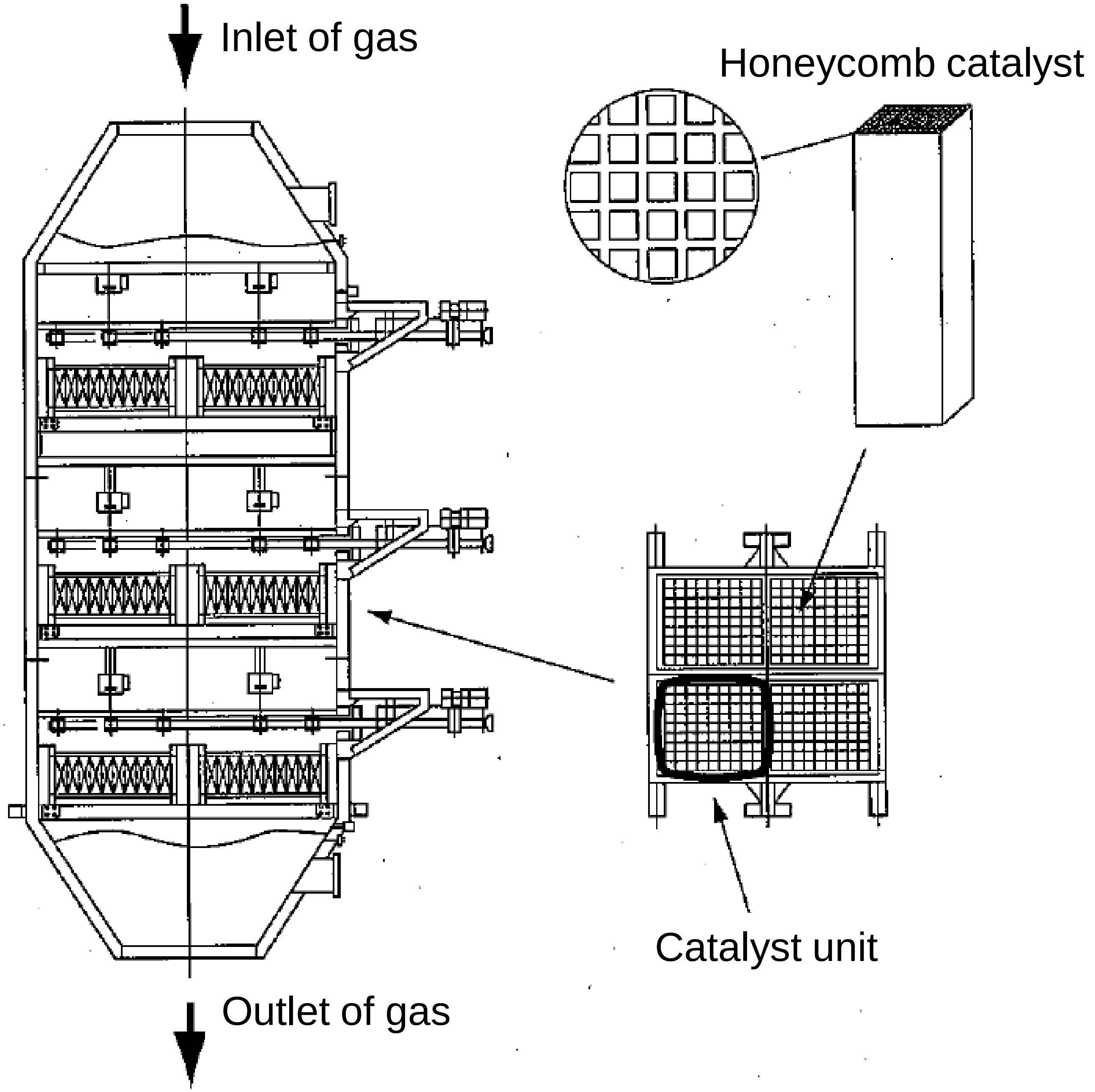
Example of process flow of general waste incineration plant



Concentration change of dioxins at inlet and outlet of catalytic bag filter



Example of catalytic reactor with honeycomb catalyst



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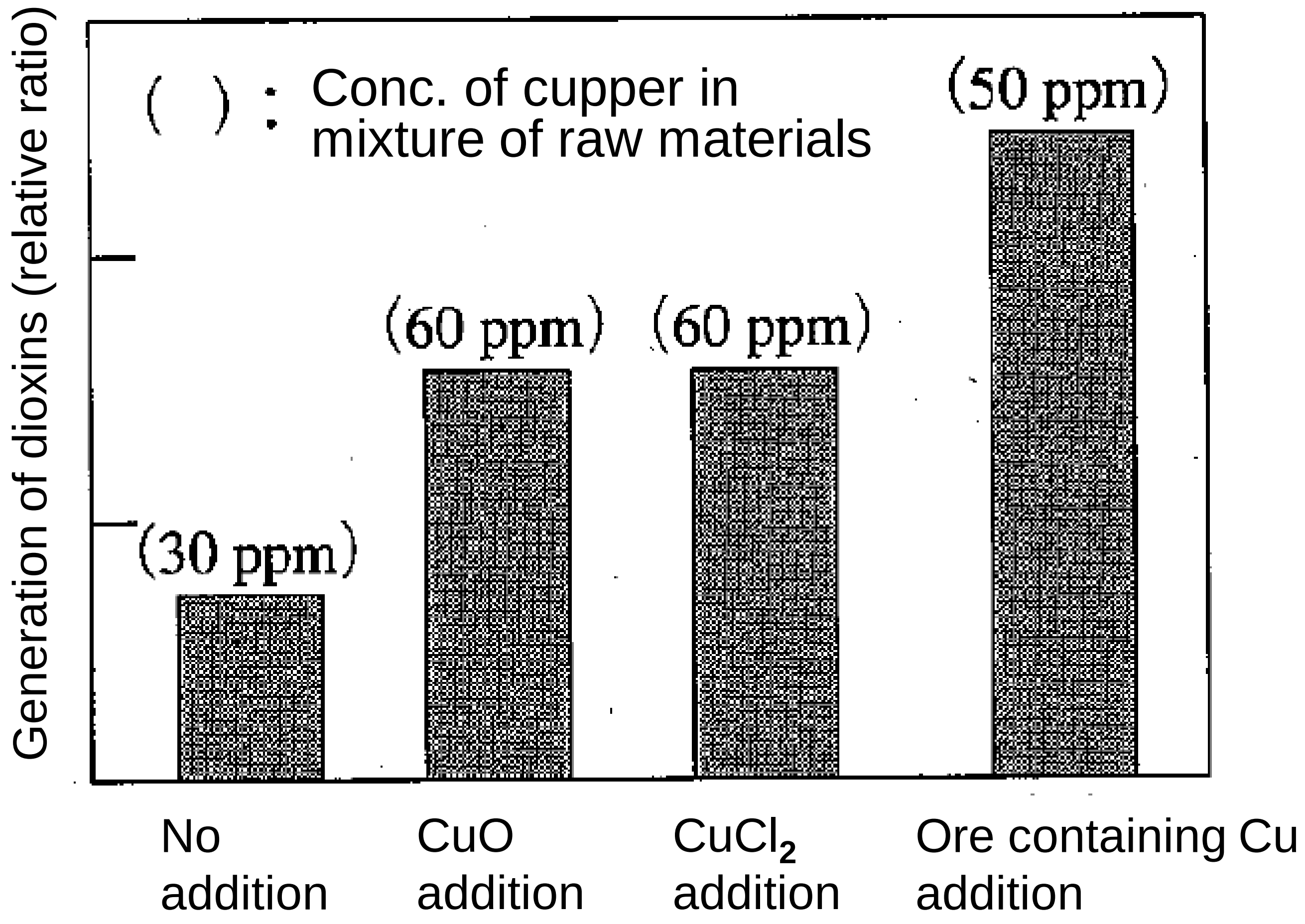
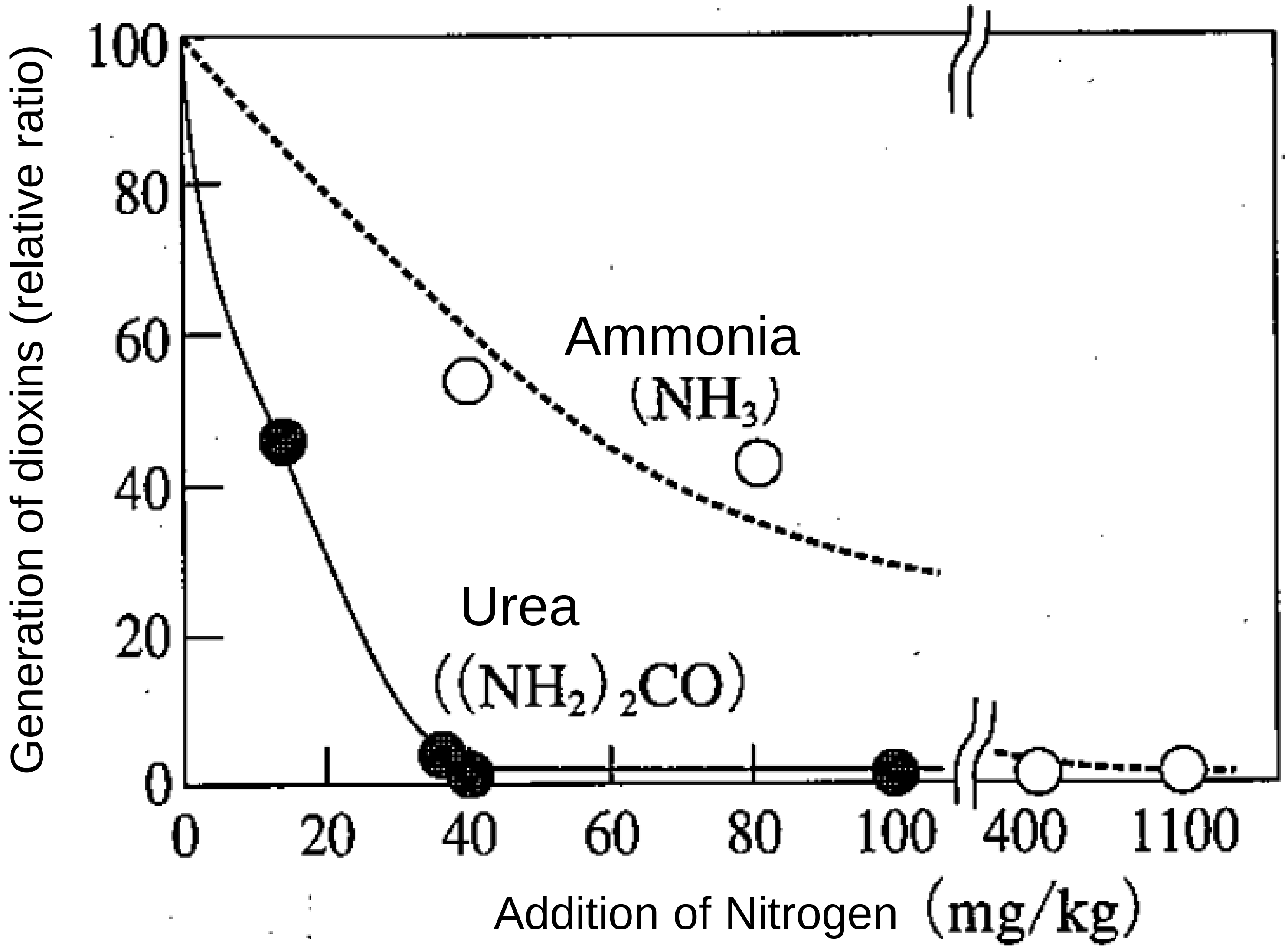
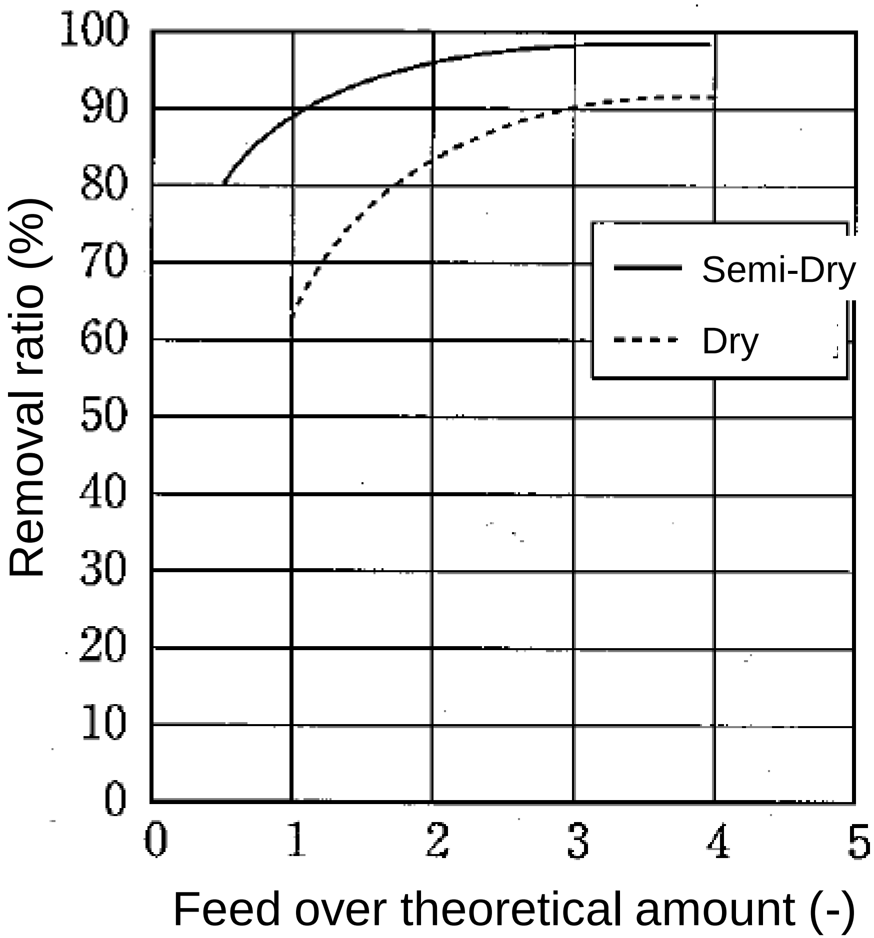
Effect of cupper concentration in mixture of raw materials for dioxins' generation at Sintering furnace of iron ore



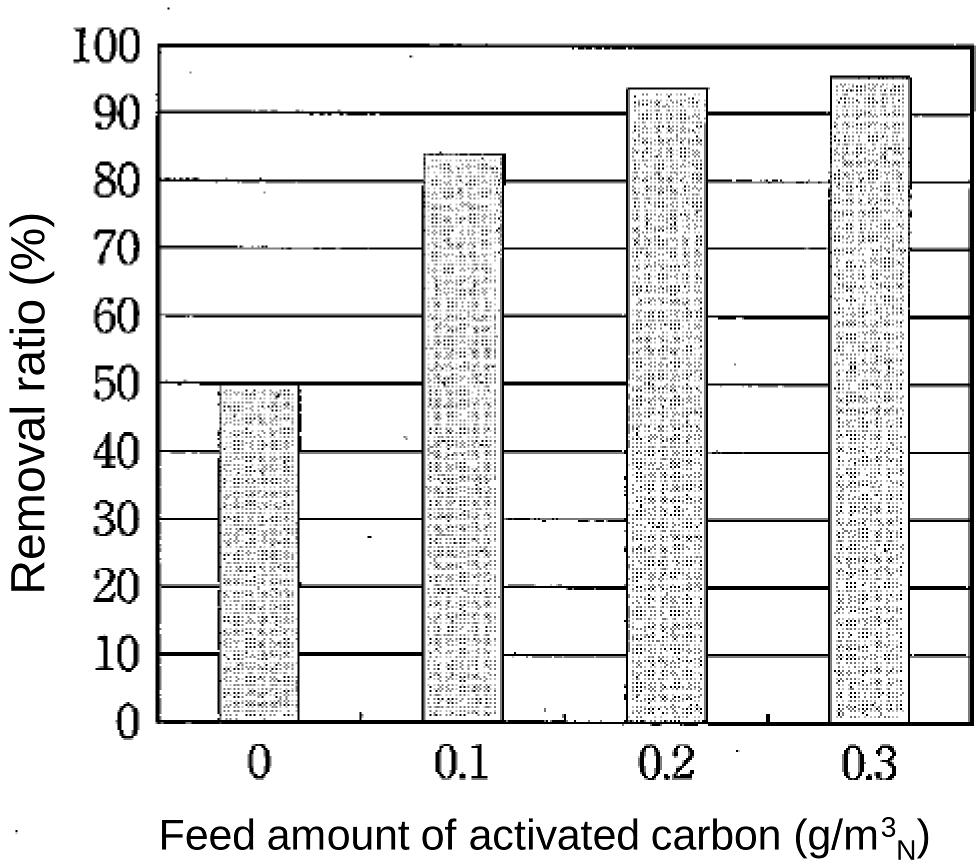
Effect of ammonia and urea concentration in mixture of raw materials for dioxins' generation at Sintering furnace of iron ore



Example of amount of slaked lime and activated carbon powder to remove Hydrogen chloride and Dioxins

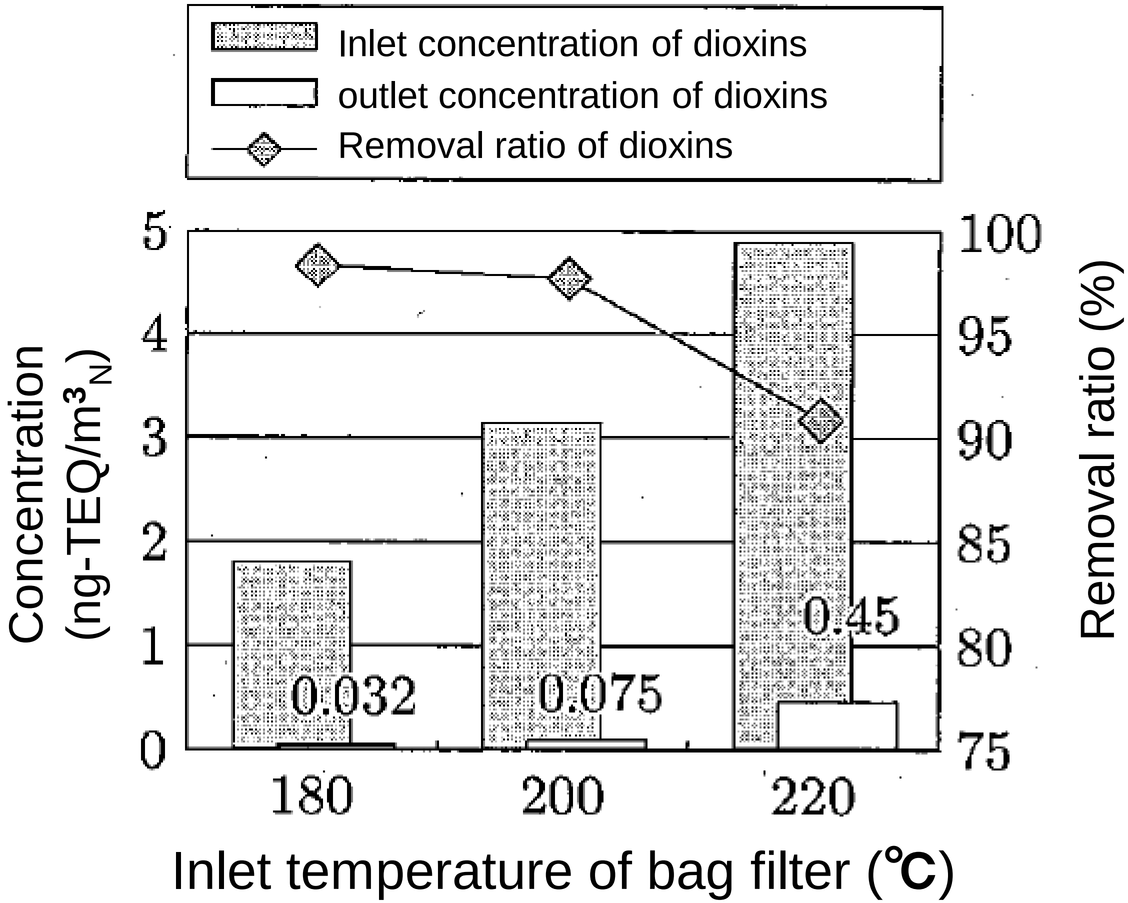


Removal ratio of HCl

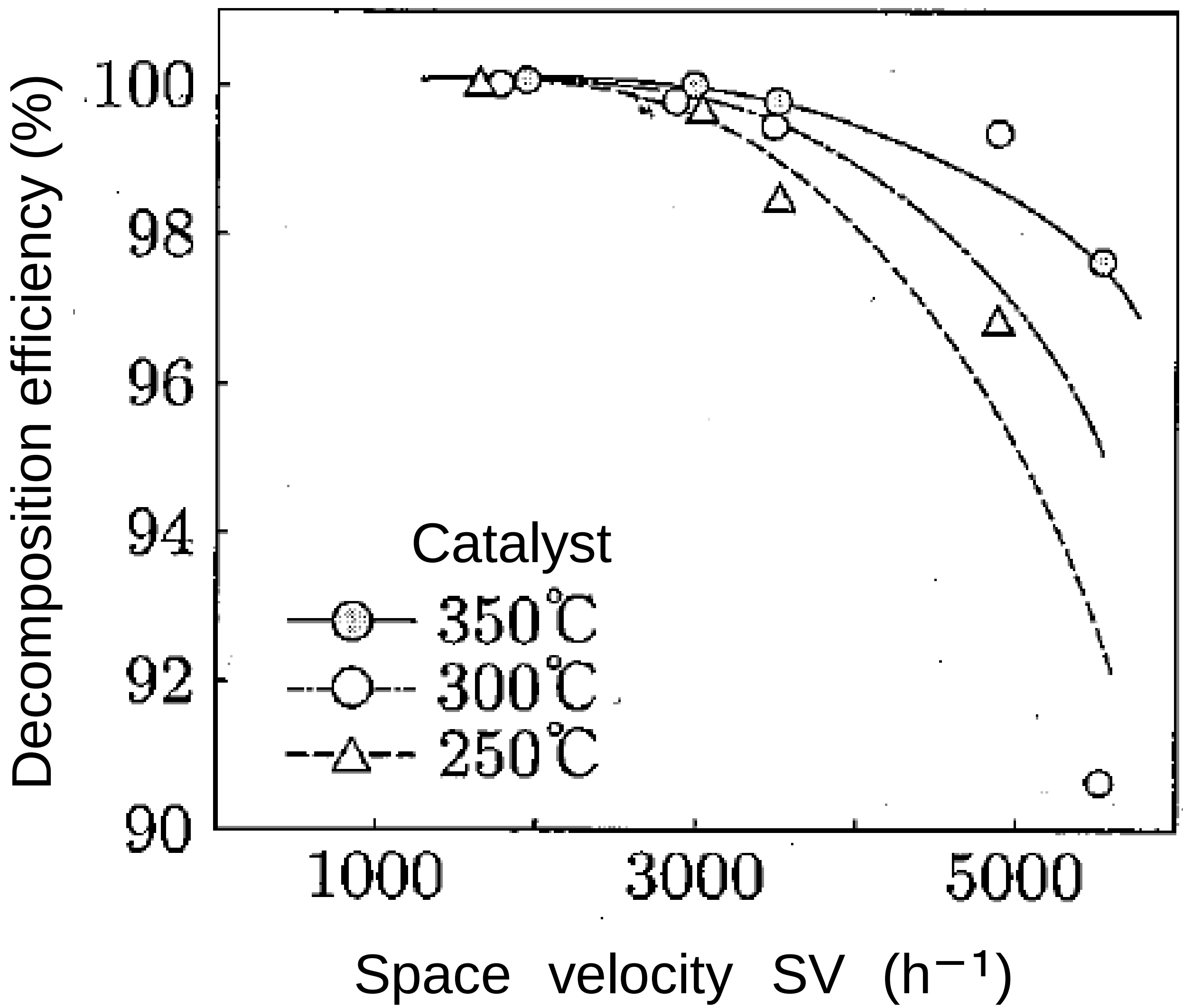


Removal ratio of dioxins over feed amount of activated carbon

Example of relationship between removal of dioxins with catalytic bag filter and inlet temperature of bag filter



Example of oxidation decomposition of dioxins with catalyst



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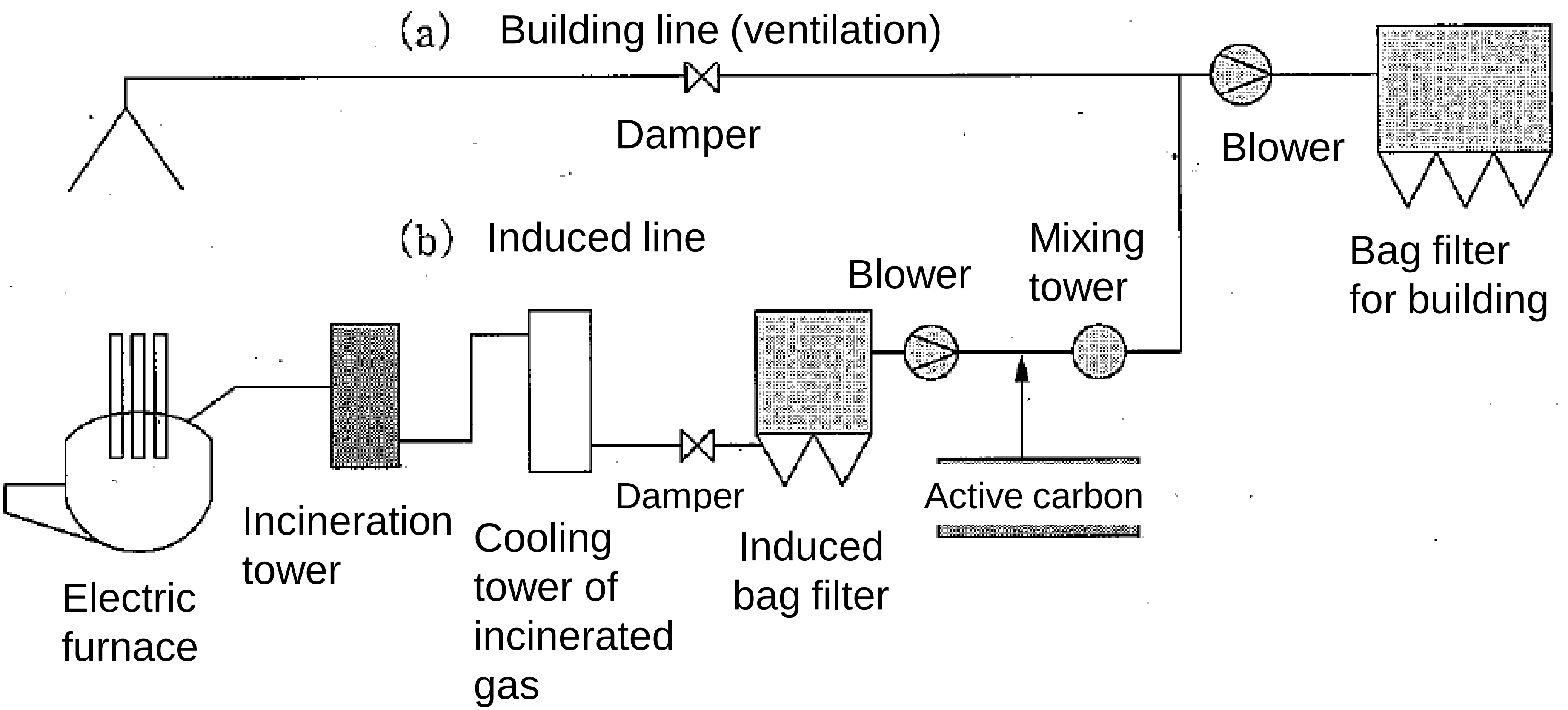
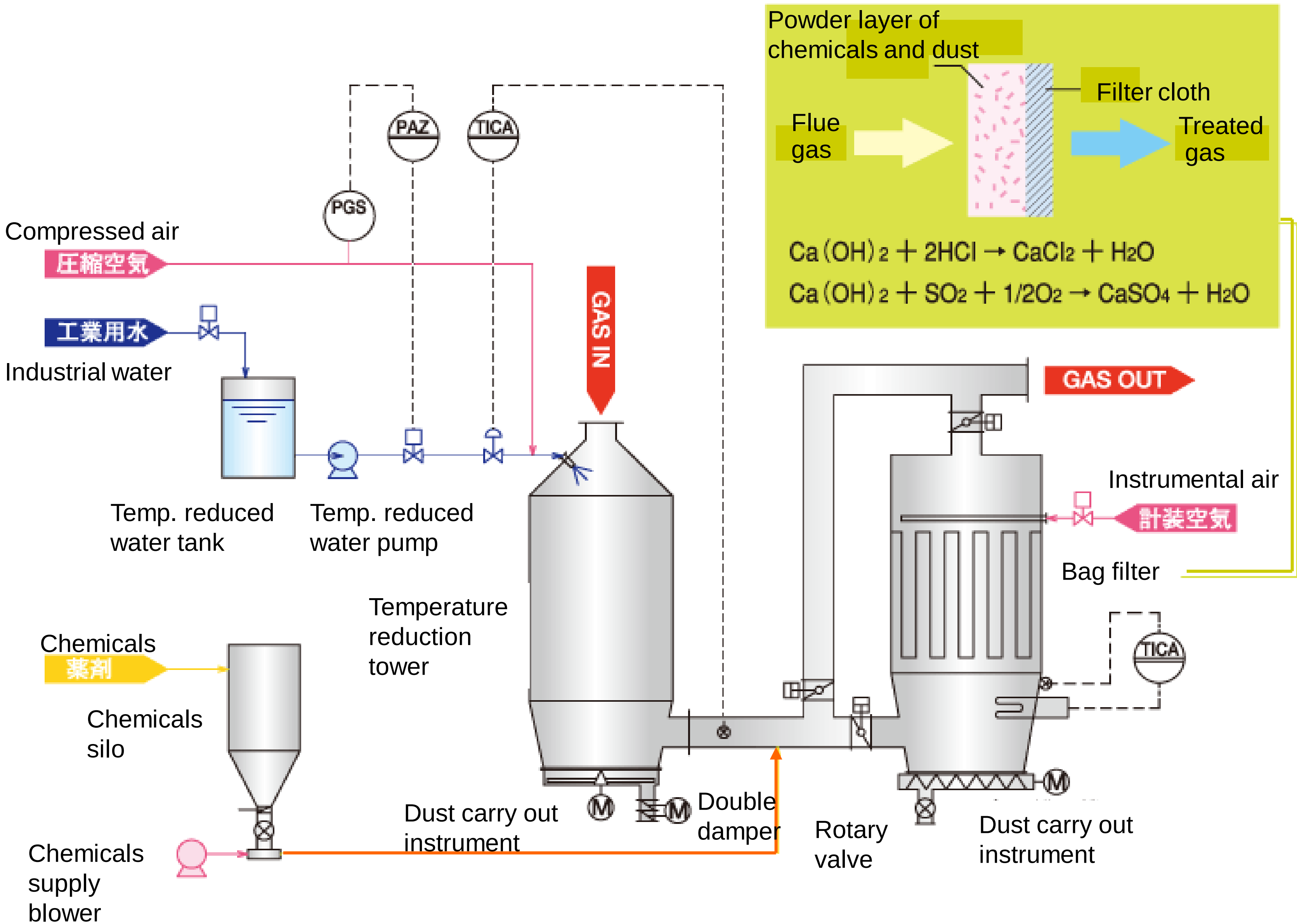
Process flow of second step bag filter and activated carbon supply method

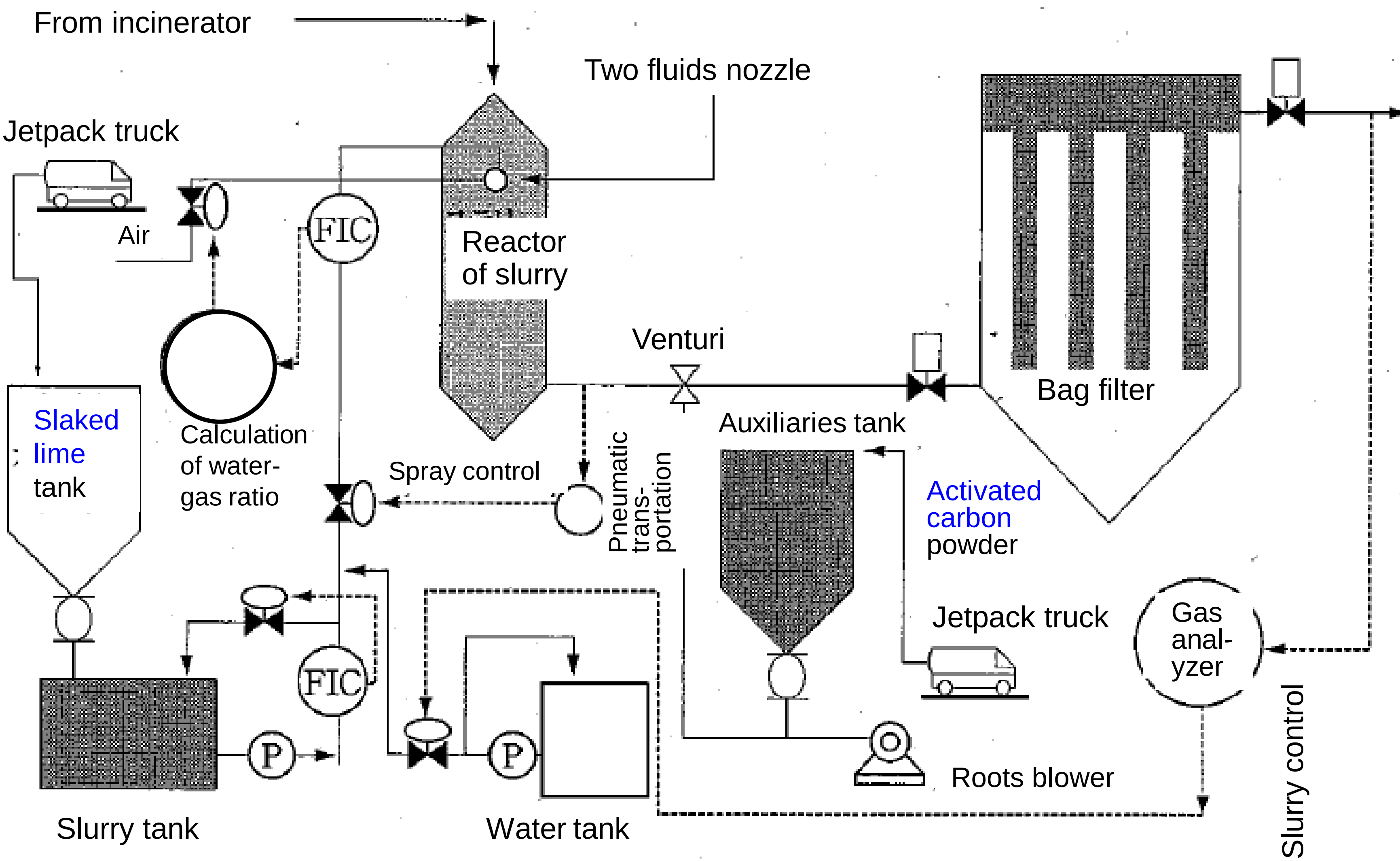


Example of flue gas treatment flow from incinerator

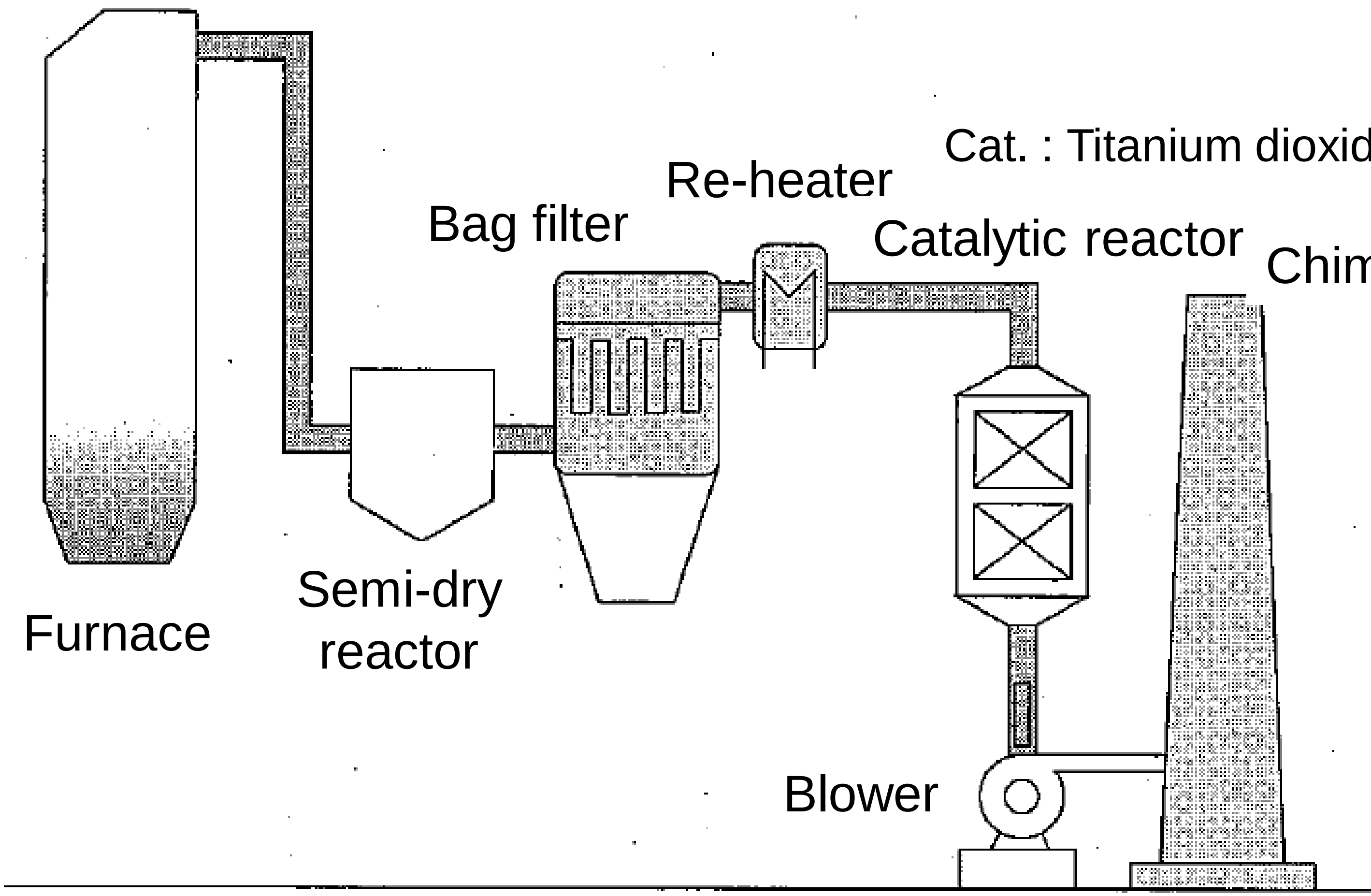


Source : HP of Kurabo Industries Ltd.

Example of flue gas treatment flow from incinerator



Example of flue gas treatment flow with catalytic reactor



Contents

Decomposition technologies of Dioxins in fly ash etc

Decomposition technology	Summary of technology
Melting type	Dioxins are heated over melting point（at around 300 ℃) and thermally decomposed.
High temperature incineration type	Dioxins are thermally decomposed at around 1100 ℃ under oxidation condition.
Gaseous phase reduction with hydrogen type	Dioxins are decomposed at over 850 ℃ by reduction and dechlorination reaction with hydrogen under the condition of without oxygen and with hydrogen.
Dechlorination by heating under reduction condition type	Dechlorination by heating at around 400 ℃ under the condition of lack of oxygen such as methods of replacing of Nitrogen)
Decomposition by hydrooxidation under supercritical condition type	Decomposition of dioxins by using the power of solubility of supercritical water against organic matters at 374℃ and 22.1 MPa or more.
Decomposition with dispersed metal sodium in oil type	Decomposition of dioxins by the reaction between extracted or concentrated dioxins and ultrafine particle of metal sodium dispersed in oil.
Photo chemical decomposition type	Dioxins are decomposed by dechlorination reaction by using irradiation such as ultraviolet and oxidation power of ozone etc.

Thank you for your attention !!

JEMAI