27 3

……

…… ……1

(BrO₃⁻) …… …15

…… ……24

…… ……33

…… …46

GSEC …… ……51

…… ……57

…… …62

— ISO14001 ……

…… …70

IWA

……81

……94

150

( ) tinlai@mail.water.gov.tw

1

900

500 400

400

(02)25042350

www.ctwwa.org.tw

92 3 26 09200118440

○ 2995

(02)25073832

(02)25042350

(04)22244191 514

( ) 50

(04)23607717

/

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（WWF World

Wild Fund for Nature

（ ）

（ ）

27 3

3,41

( )

350 (

250)

3,400 1.5

( )

83

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93

94

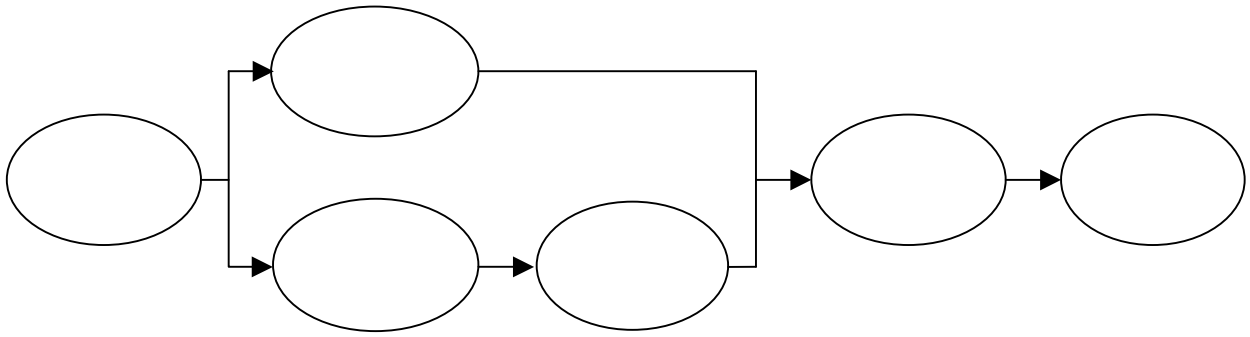
(97)

( )

96 23,11%

14.5% 7,1% 9,0%

9,1% 1



1

( )

( )

15

10.84 ( ) 94

2 3

4

1

3

17

17

( )

5

1.

2% 4%

0.5%~0.6%

2.

0.23%

3.

1

A		/M3	95 GNI /		(/M3	D
		A	B	C=B/	D=A/C	
1		181.70	51,700	3.59	50.64	1
2		99.50	36,550	2.54	39.23	2
3		89.70	36,620	2.54	35.30	3
16		10.74	5,490	0.38	28.19	4
4		65.00	38,410	2.67	24.39	5
5		61.60	40,180	2.79	22.09	6
8		39.50	29,320	2.03	19.41	7
6		55.60	42,670	2.96	18.78	8
7		51.80	40,650	2.82	18.36	9
9		34.40	27,570	1.91	17.98	10
10		31.60	27,250	1.89	16.71	11
11		27.00	28,460	1.98	13.67	12
14		10.80	14,410	1.00	10.80	13
17		8.24	17,690	1.23	6.71	14
13		16.00	36,170	2.51	6.37	15
12		19.30	44,970	3.12	6.18	16
15		10.74	35,990	2.50	4.30	17

2

13	17.85	150	5,301.45
20	35.70	200	10,531.50
25	66.15	250	18,599.70
40	196.35	300	29,184.75
50	357.00	350	41,626.20
75	963.90	400	58,119.60
100	1,909.95		

3

	M^3	
	1-10	7.350
	11-30	9.450
	31-50	11.550
	50	12.075

1.

2.

10.84

20-30 /

3.

( )

5%~9%

0.10 -0.42 (-0.10

)

100

965

-1.03% 4 5

4.

4 93~96

	93	94	95	96
	510.6	490.7	474.7	461.0
	-0.42%	0.10%	-0.16%	-0.07%
	97.9	106.9	98.6	115.8
	5.4	10.3	13.6	3.8
	92.5	96.6	85.0	112.0

1. + + 2.

5 97~100

	97	98	99	100
	460.1	609.8	814.4	965.3
	-0.24%	-0.58%	-0.70%	-1.03%
	147.1	237.7	281.5	236.5
	13.5	4.5	-	-
	133.6	233.2	281.5	236.5

( )

1. (Efficiency Principle)

2. (Equity Principle)

3. (Financial Requirement Principle)

4. (Public Health Principle)

5. **(Environmental Efficiency Principle)**

3.

( )

5%~9%

1.

5%

( )

×(1)

2.

( )

1.

6

7

(1)

95

7 2.9 96 5%~9%

3.4 2.2

27 3

86

(

92

4.502 11.382 /M³

12 7) 3.41

16.45 /M³

8.8

44.56%

(2) 30%

1~10 10

30%

(4) 25

20%

20

20

16.45 /M³

20

(3)

51 51~200

1998

200

6 ( )

				(30%)	(11.17%)
( )			( )	( )	( )
	%	%	(/M³)	(/M³)	(/M³)
1 10	25.92	35.04	7.35	7.35 (0.0%)	7.35 (0.0%)
11-20 (11-30)	16.96	27.5	9.45	9.45 (0.0%)	9.45 (0.0%)
21-50 (31-50)	15.84	31.54	11.55	12.71(10.0%)	13.86 (9.0%)
51-200	7.58	5.27	12.075	14.73 (22.0%)	16.91 (14.8%)
201 ↑	33.71	0.65	12.075	16.23 (34.4%)	20.10 (23.8%)
			10.08	12.11	13.76
			1.302	2.69	2.69
			11.382	14.80 (30.00%)	16.45 (11.17%)

7 ( )

				(20%)	(20.44%)
( )			( )	( )	( )
	%	%	(/M³)	(/M³)	(/M³)
1 10	25.92	35.04	7.35	7.35 (0.0%)	7.35 (0.0%)
11-20 (11-30)	16.96	27.5	9.45	9.45 (0.0%)	9.45 (0.0%)
21-50 (31-50)	15.84	31.54	11.55	11.90 (3.0%)	13.86 (16.5%)
51-200	7.58	5.27	12.075	12.92 (7.0%)	16.91 (30.9%)
201 ↑	33.71	0.65	12.075	13.64 (13.0%)	20.10 (47.4%)
			10.08	10.97	13.76
			1.302	2.69	2.69
			11.382	13.66 (20.00%)	16.45 (20.44%)

2.

8

8

	4.502	5%	6%	7%	8%	9%
(/)	16.45	16.78	17.67	18.55	19.44	20.32
(/)	106	114	132	151	170	188

(2) (3)

( ) (4)

(5) 105

1,247

9

(98 105) (1)

9 98~105

			98-105
			12.3
			10.1
			39.3
			1.7
			138.0
		-	178.6
		60 CMD	83.3
			30.0
		7	4.8
			526.0
			13.0
		-	4.5
			12.2
		(-)	4.0
		-	19.3
		-	5.7
			52.0
			3.4
			5.9
			3.7
		94 98 --	1.0
			6.7
			15.6
			5.9
			1.4
			1.2
			1.0
			1.2
			1.8
			60.1
			2.8
			1,247

( )

92 12

4. **20 ~35**

(1) :

(2)

( )

1. **50 ~68**

(1) 100 (3)

10

(2) ( )

5. **5**

2. **4 ~5** (1)

24

(2)

3. **25**

~155

105

95%

27 3

2.

1.

9.3

4~9

2. **3.**

1

3.

4.

20~30

98

10

5.

( )

6.

1 (2 3)

(4 5) (6

) (7)

7.

1.

10 (98)

	(/)	(/)	98	
4.502	16.45	106	1. 2. 3. 4. 5. 6.	50 28 4 12 8 4
5%	16.78	114	1. 2. 3. 4. 5. 6.	50 30 4 15 10.5 4.5
6%	17.67	132	1. 2. 3. 4. 5. 6.	50 40 4 20 13.5 4.5
7%	18.55	151	1. 2. 3. 4. 5. 6. 7. 8.	50 40 4 20 13.5 3 4.5 16
8%	19.44	170	1. 2. 3. 4. 5. 6. 7. 8. 9.	50 50 4 20 15.5 4 4.5 1 21
9%	20.32	188	1. 2. 3. 4. 5. 6. 7. 8. 9.	50 50 4 25 20 5 4.5 1 28.5

97

(Quality)

(Innovation) (Credibility)

(Knowledge)

1.

94

2.

92

3.

89

4.

87

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- (BrO_3^-)

/

Br^- - BrO_3^- WHO 10μg/L BrO_3^-

(TiO_2) UV BrO_3^- BrO_3^- TiO_2 UV UV TiO_2 185nm 500~650 μ g/L BrO_3^- 99 BrO_3^- 1 μ g/L GAC TiO_2 UV-254nm BrO_3^- 90 BrO_3^-

Br^- Bromate , BrO_3^-

BrO_3^-

BrO_3^- bromofom bromoacetic acids bromophenols aldehydes assimible organic carbon, AOC

BrO_3^- [1] pH HOBr BrO^- BrO_3^- pH BrO_3^- HOBr HOBr pH BrO_3^- BrO_3^- pH pH pH [2]

BrO_3^- BrO_3^-

70 2

BrO_3^- 5 μg/L

Life-time 10^{-4} 10000

BrO_3^-

[3] D/DBPs

BrO_3^- MCL 10 μg/L [3]

BrO_3^-

BrO_3^-

≡ C +BrO_3^- → BrO^-+ ≡ CO_2

≡ C +2BrO^- → 2Br^-+ ≡ CO_2

≡ C ≡ CO_2

BrO_3^- BrO^-

Br- Br^-

BrO_3^-

isolelectric point, pHzpc

acid-basic groups

pH_{zpc} BrO_3^- [5-7]

(Heterogeneous photocatalysis reaction)

-

[8]

[9]

(valence band, VB) (e^-)

(conduction band, CB)

, -

(electron-holepair)

H_2O O_2

O^-

O_2^- O_3^- OH^-

TiO_2 ZnO CdS WO_3

TiO_2

/ pH

(DO) (OH

scavenger)

UV < 320 nm

(OH radical)

(visible light)

(TiO_2-Nd TiO_2-Pt

TiO_2-Co $SrTiO_3$ nitrogen-containing ZnO

ZnO- Fe_2O_3 ZnO- WO_3)

[10]

(Fe^{+2})

185 nm

BrO_3^- UV 254nm

BrO_3^- UV

BrO_3^- [11]

$$BrO_3^- \xrightarrow{UV} BrO^- + O_2$$

$$BrO^- \xrightarrow{UV} Br^- + \frac{1}{2}O_2$$

UV BrO_3^-

0.6~60 900~1900 M

w/cm^2

BrO_3^-

UV BrO_3^-

TiO_2

γ -Al_2O_3

BrO_3^-

BrO_3^-

BrO_3^-

( )

TiO_2

1

1 TiO_2

(FESEM)

(2

) 10×60 (ID x H)

UV

UV-254 UV-185 (2

UV-254 UV-185)

1 TiO_2

2 TiO_2

GAC γ -Al_2O_3 3

4 BrO_3^{-1}

1 (TiO_2)

Index	Nano-size
Appearance	White powder
Content of titanium oxide (%)	>99%
Grain size (nm)	10~20
Specific surface area (m^2/g)	330
Loss of weight in drying (%)	0.5
Loss of weight in burning (%)	1.0
pH vale of aqueous suspended metter	7-8(untreated type)

2 UV-254 UV-185

	UV-254	UV-185
	17 3/4	17 3/4
	20W	20W
	254nm	185nm
	15W	15W
(HxD)	435x25mm	435x25mm
	0.425A	0.425A

( )

1.TiO_2

46 g pH

HNO_3 2~3 0.5g

GAC Al_2O_3 7.1065g

Titanium Tetraisopropoxide 3

12 **2.**

GAC 640 μg 5 μM

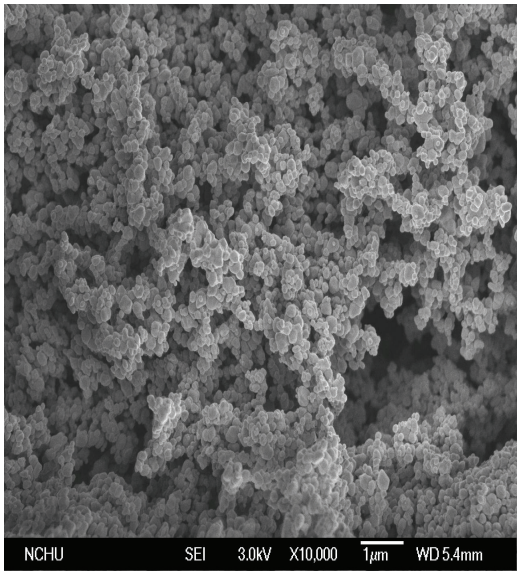
Al_2O_3 400℃ 1 TiO_2 Al_2O_3 Al_2O_3/ TiO_2

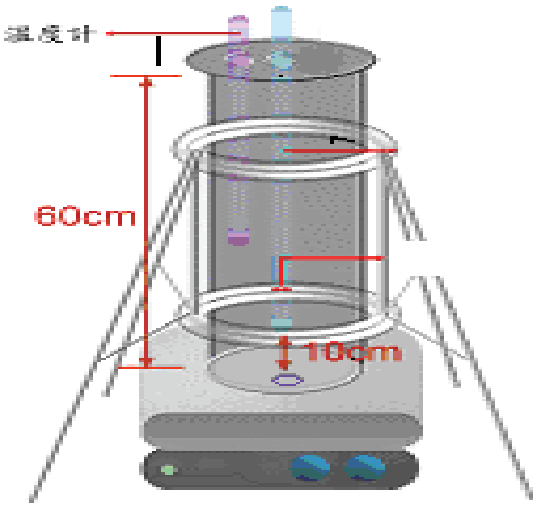
GAC GAC/TiO_2

FESEM 150rpm

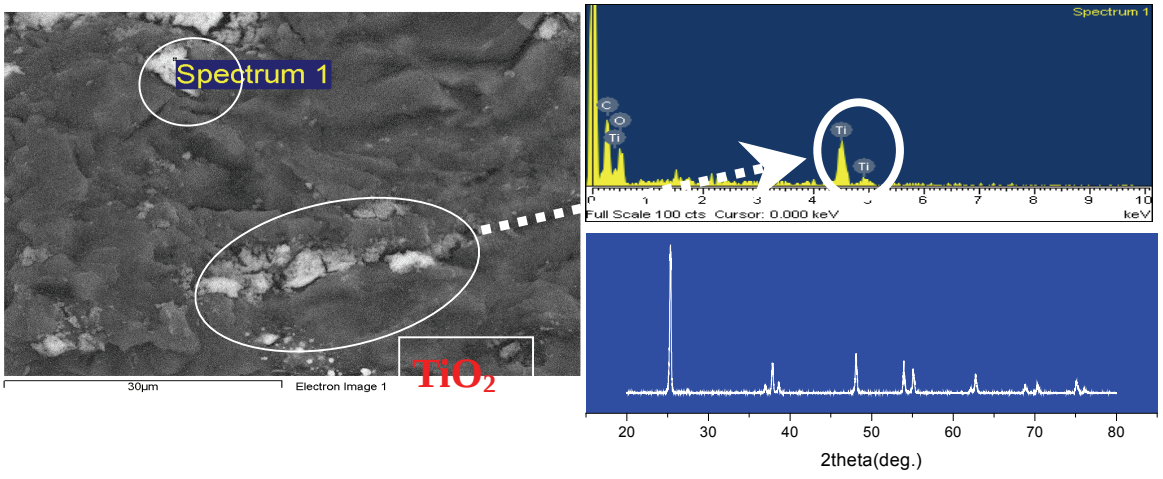
EDS X-ray BrO_3^-

TiO_2 GAC Al_2O_3





1 TiO_2 FESEM 2



3 GAC/TiO_2FESEM EDS X-ray

3.BrO_3^-

BrO_3^-

640 μg 5 μM

TiO_2 GAC/TiO_2

Al_2O_3/TiO_2 UV

BrO_3^-

BrO_3^-

UV

TiO_2 BrO_3^- 254nm

180nm UV

BrO_3^- 5 μM 1 μM

UV

254nm 180nm

UV BrO_3^-

4.

IC

BrO_3^- Br^-

( )GAC GAC/TiO_2

GAC BrO_3^-

4 a GAC BrO_3^-

4 b

TiO_2 GAC GAC/TiO_2 BrO_3^-

GAC/TiO_2 BrO_3^-

GAC

TiO_2

GAC GAC

TiO_2 BrO_3^-

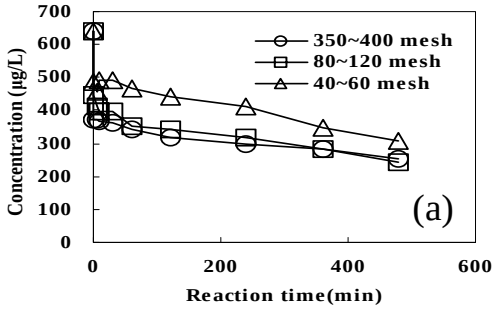
GAC GAC/TiO_2

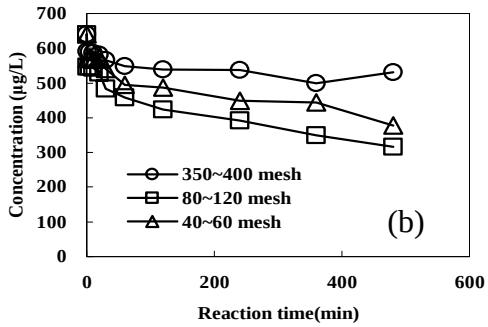
5 GAC

GAC/TiO_2

350-400

mesh

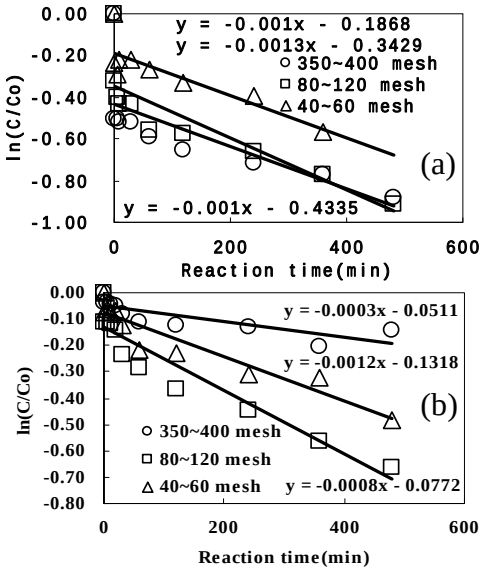




4 GAC

GAC/TiO_2 BrO_3^- (a)GAC

b GAC/TiO_2



5 (a)GAC (b)GAC/TiO_2 BrO_3^-

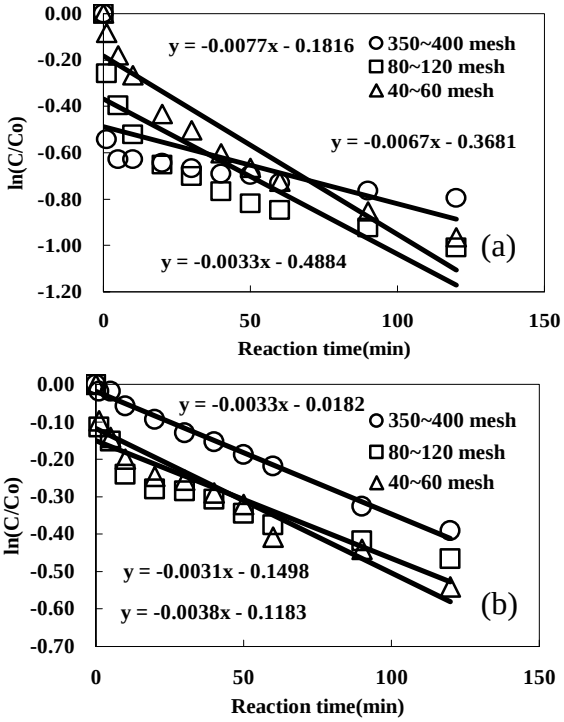
/

( )UV-254 GAC GAC/TiO_2 BrO_3^-

UV-254 GAC GAC/TiO_2 6 UV-GAC BrO_3^- GAC BrO_3^-

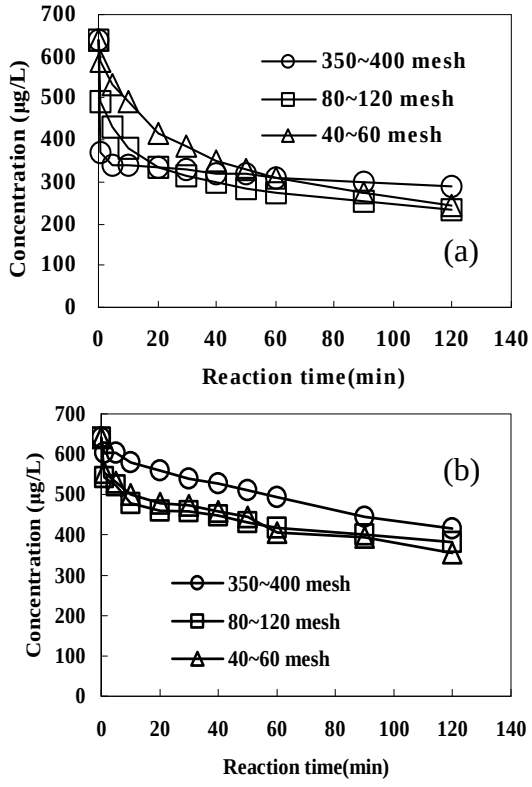
GAC/TiO_2 BrO_3^- TiO_2

7 UV-GAC UV-GAC/TiO_2 BrO_3^- 3 k GAC BrO_3^-



7 GAC GAC/TiO_2 (a)GAC(b)GAC/TiO_2

( )BrO_3^- Br^-



6 UV-GAC UV-GAC/TiO_2 BrO_3^- (a)UV-GAC(b)UV-GAC/TiO_2

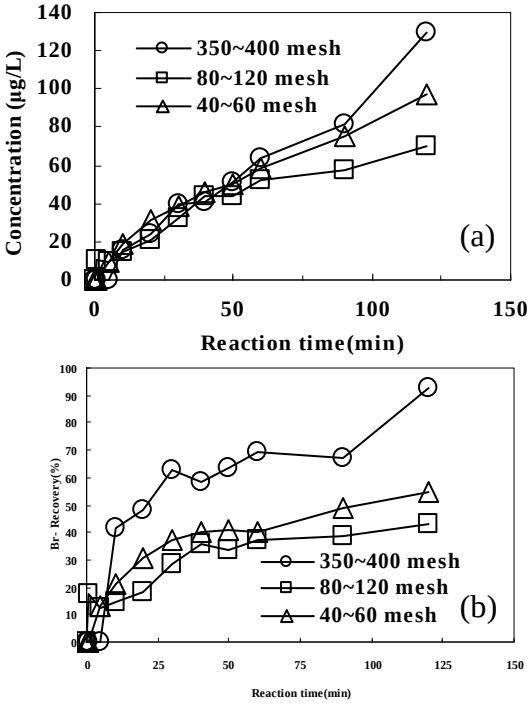
8(a) BrO_3^- GAC BrO_3^- Br- 8(b) BrO_3^- Br- 50~70 30~50

( ) UV TiO_2 BrO_3^-

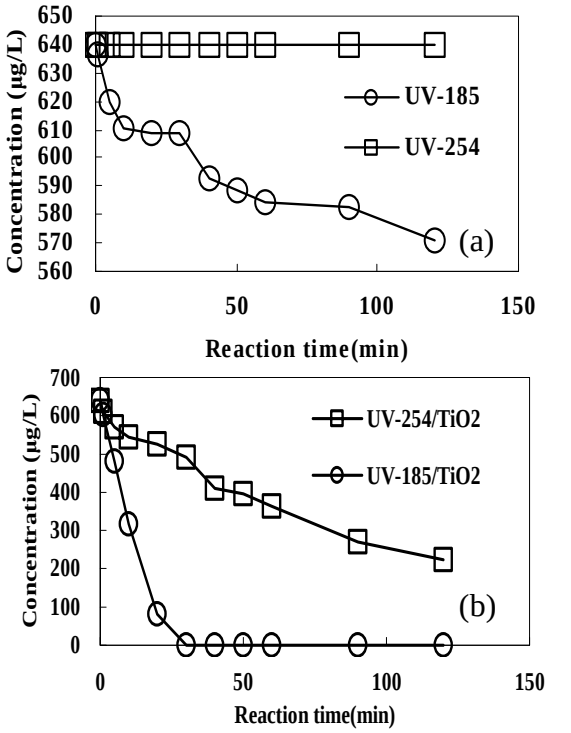
9(a) UV 254nm BrO_3^- UV 185nm BrO_3^- 9(b) TiO_2 BrO_3^- UV-254 BrO_3^- UV-185 99 10 BrO_3^-

3 k

	GAC	GAC/TiO_2	UV-GAC	UV-GAC/TiO_2
350~400 mesh	0.0010	0.0003	0.0033	0.0033
80~120 mesh	0.0013	0.0012	0.0067	0.0031
40~60 mesh	0.0010	0.0008	0.0077	0.0038



8 BrO_3^- Br^- (a)Br^- (b)Br^-

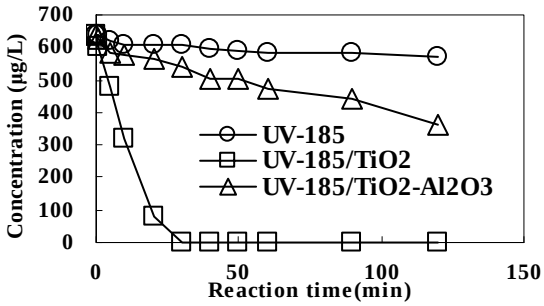


9 UV BrO_3^- (a) UV BrO_3^- (b)UV/TiO_2 BrO_3^-

TiO_2

( ) UV Al_2O_3/TiO_2 BrO_3^-

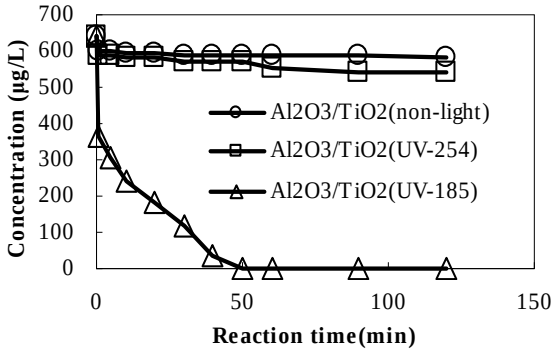
11 Al2O3/TiO2 =2500mg/L BrO_3^- UV-185 99 12 UV-185 Al_2O_3/TiO_2 k UV-185 BrO_3^-



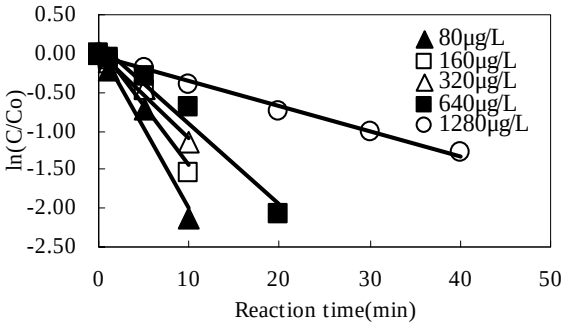
10 UV-185 BrO_3^-

Langmuir-Hinshelwood

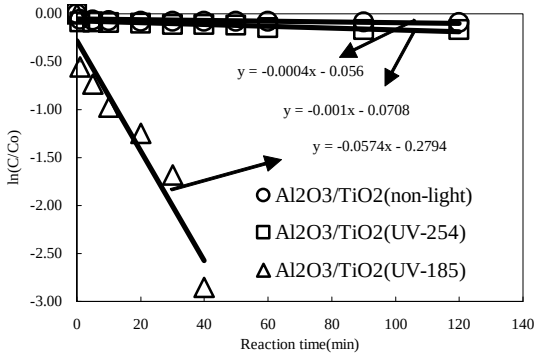
$$\frac{C_0}{r_0} = \frac{1}{k} C_0 + \frac{1}{kK_H}$$



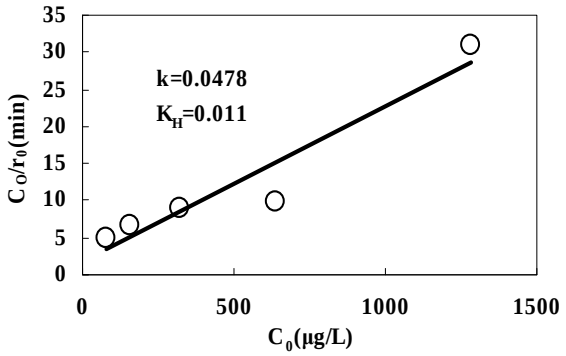
11 Al_2O_3/TiO_2 BrO_3^-



13 BrO_3^-



12 Al_2O_3/TiO_2



14 TiO_2/UV-185 BrO_3^- Langmuir-Hinshelwood Model

BrO_3^- - Active sites TiO_2 - KH ( ) GAC/TiO_2 BrO_3^- k 13 BrO_3^- GAC TiO_2 80~1280 μ g/L BrO_3^-

14 Langmuir-Hinshelwood ( ) UV-254 UV-185 $K_H=0.011m^3/g \cdot min$ k=0.0478 g/m^3 BrO_3^- UV-185 30% UV-254

( ) GAC GAC TiO_2 GAC/TiO_2 ( ) $UV-185/TiO_2$ BrO_3^- BrO_3^- GAC 99 $UV-254/TiO_2$ GAC/TiO_2 BrO_3^- GAC UV-185 ( ) $UV-185/TiO_2$ BrO_3^-

TiO_2

TiO_2 γ

$-Al_2O_3$ TiO_2

TiO_2 BrO_3^-

99

( ) TiO_2/UV-185

BrO_3^-

Langmuir- Hinshelwood

KH=0.011m3/g.min

k=0.0478g/m3 - -

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”.

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93

4

Procter & Gamble

(Division of Labor)

(Integration)

Drucker(1974)

(Society of Institutions)

Suboptimization

Drucker (Management by Objectives)

Drucker (Motivation)

(Participation)

→ →

→

Connor 1974

→

(Process)

Optimization (Functions)

91

Performance Standard

(Acting)

P-D-C-A

Management Cycle 1

(Planning) Policy

Strategy Procedure

Schedule Budget

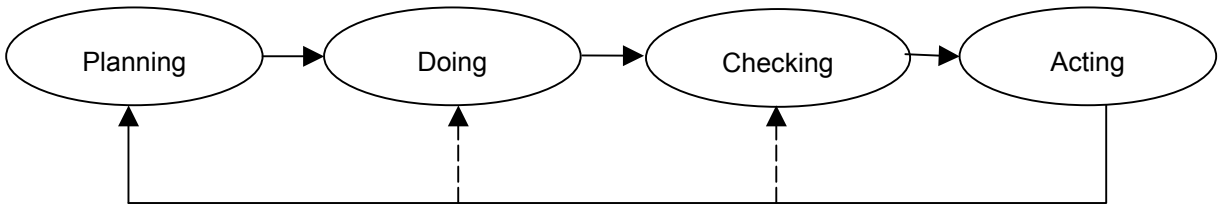
Objective

(Doing)

(Checking)

Drucker (1954) (Management by Objectives MBO)

(Top-down) (Bottom-up)



1

( )

Y

(McGregor)

The Human Side

of Enterprise

Theory Y the Integration

of Goals Y

1.

2.

(Organizing)

3. (Staffing) (Directing)

(Controlling)

4.

5.

6.

7. Y

2

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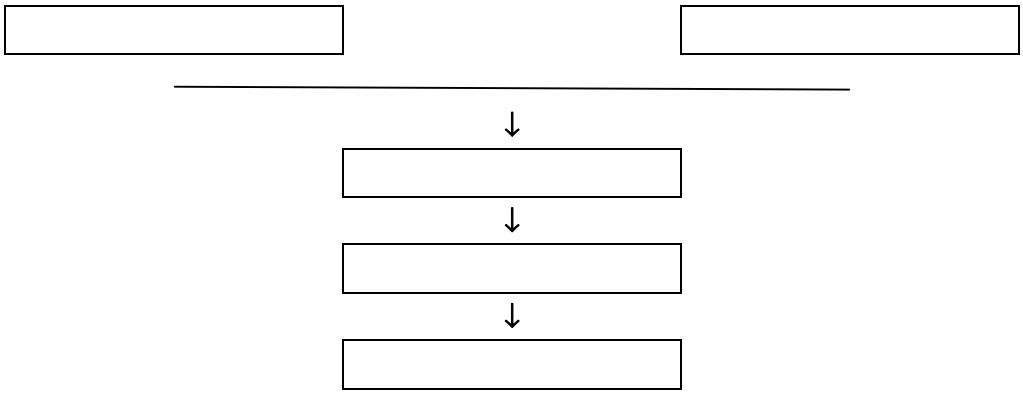

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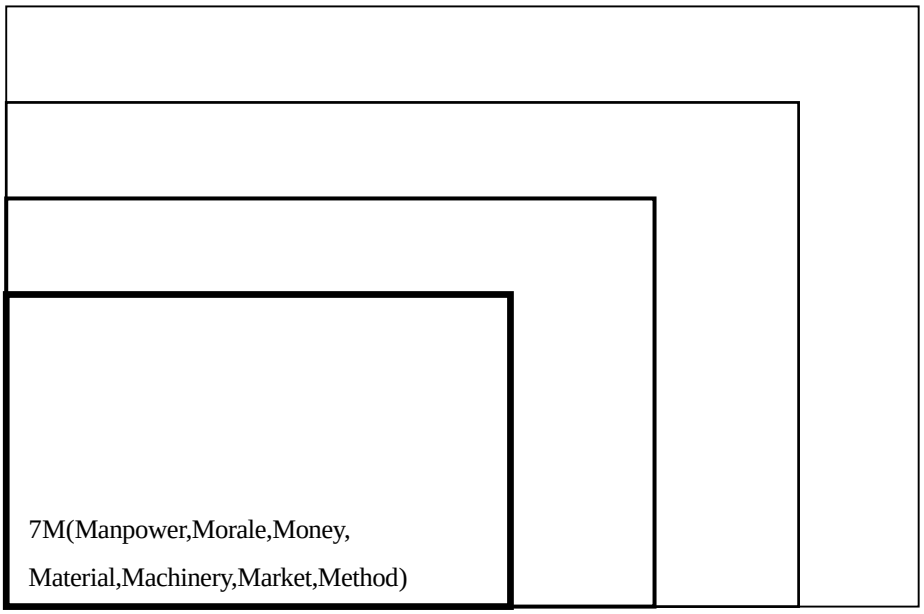

3

( ) 3

(Internal Environment)

( )

(7M Manpower, Morale, Money, Material, Machinery, Market, Method)

(External Environment)

1. (Market Environment)
2. (Macro-Environment)
3. (Extra-Environment)

1.
2.
3.
4.
5.
6.
7.