城镇污水处理厂污泥处理处置技术指南

j

..... 1

..... 2

..... 4

..... 4

..... 5

..... 7

..... 13

..... 13

..... 15

..... 23

..... 30

..... 35

..... 37

..... 39

..... 39

..... 44

..... 58

..... 60

..... 63

..... 63

..... 65

..... 68

1

2

3

4

〃 〃

5

1

m^3 80% 5~10 t

2

2.1

97 ~98

99.2 ~99.8 94 ~96

80%

m/kg

$20~60 \times 10^{12}$ m/kg $100~300 \times 10^{12}$ m/kg

$40~80 \times 10^{12}$ m/kg 1×10^{11} m/kg 1×10^{13} m/kg

2.2

T 20~60 20~60

2-2

2-2

	/ MJ/kg
	15~18
	8~12
	5~7

2006 140

2-3

2-3 **2006** **140** mg/kg

	Cd	Cu	Pb	Zn	Cr	Ni	Hg	As
	2.01	219	72.3	1058	93.1	48.7	2.13	20.2
	999	9592	1022	30098	6365	6206	17.5	269
	0.04	51	3.6	217	20	16.4	0.04	0.78

2.3

2-4

2-4

	10^5 /g	10^5 /g	10 /g	
	471.7	158.0	23.3	78.3%
	738.0	12.1	17.0	67.8%
	38.3	1.2	13.9	60%

1

90

220 t 120 t 85 t 40% 60%

60%

2009

1992 280

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2

3

5

1

1.1

GB/T24600

GB/T 23486

CJ/T 309

1.3

GB/T 23485

2

2.1

→ → →

→ → → →

→ →

2.2

→ →

→ →

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2.3

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→ →

2.4

→ → →

→ → →

2.5

→ → →

→ →

e

→

→ →

3

5 Guidelines for National Greenhouse Gas Inventories Vol 5 Waste

400~600 kg

IPCC

3-2

3-2

+			
+			
+			
+			
+			

1

94 ~96 80

2

3

3.1

c ≺

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ĭ ⌋ 9030e4a0aa3050506c7e5ba2005 Tc(~96)Tβ.1 0 TD<010c>TjTT3 1 Tf1 0

95 ~99.5 75 ~80

97 65 ~75

95

~99.5 75 ~80

4

55 ~65

78 ~85

4-1

4-1

		%	%
1		70~82	65-75
2		-	65~75
3		-	55~65
4		50~65	50
5		50~65	50

5

1

1

2

3

GB18918

2

3

3.1

1

35 ±2 20d

2.0~4.0 kg/m^3·d 35 ~45 0.75~1.10 N m^3/kgVSS

2

55 ±2

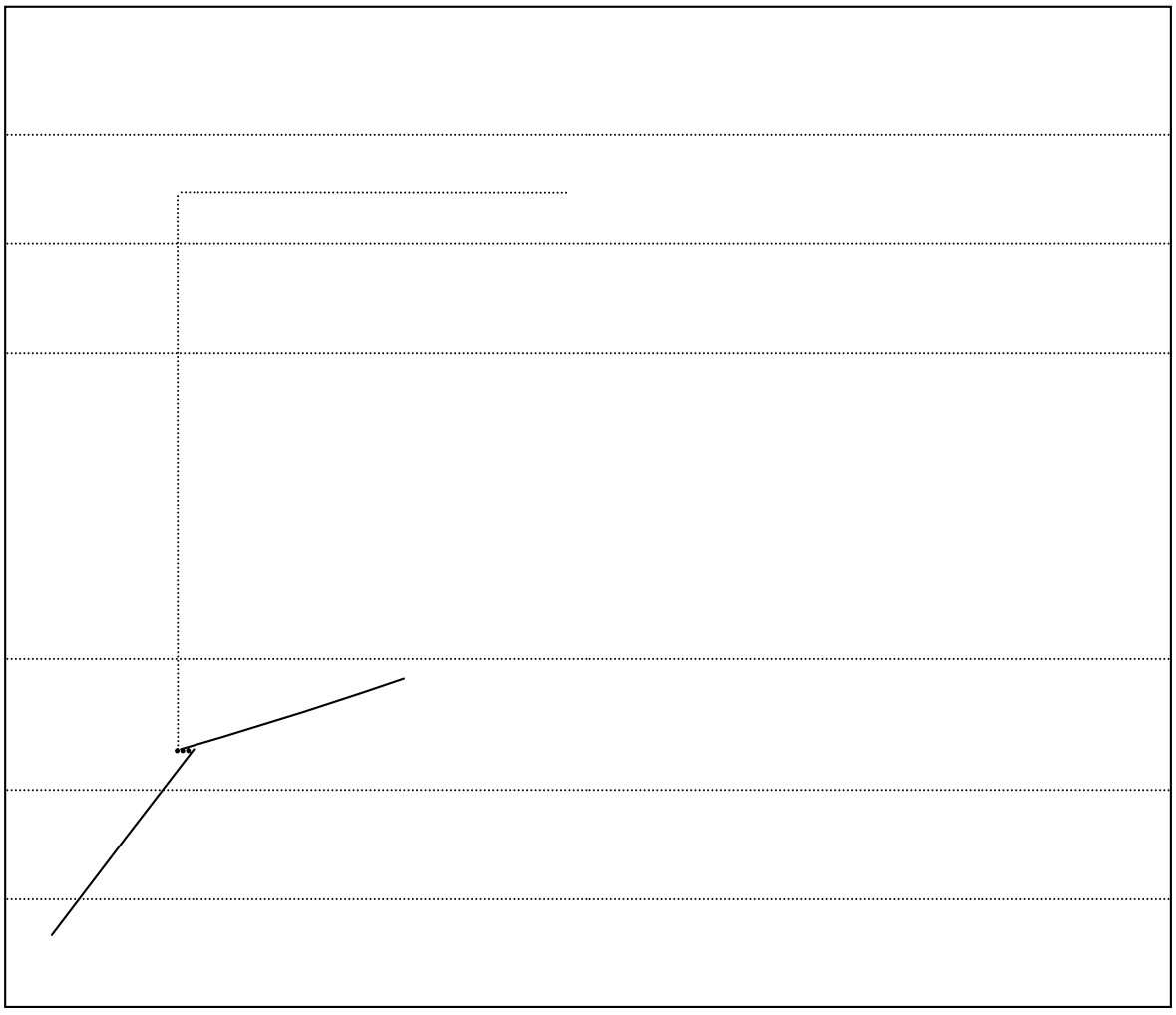
35%~45%

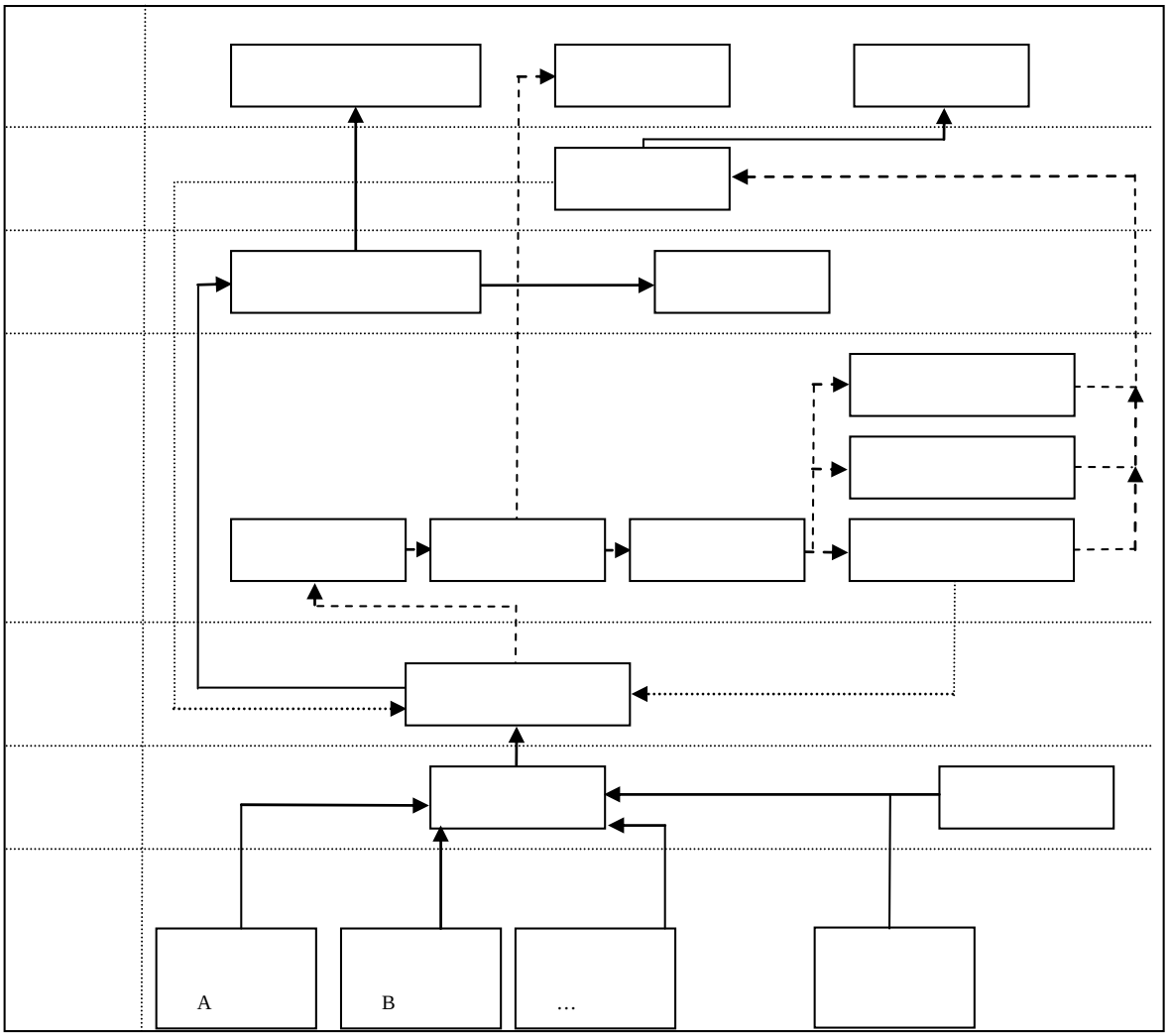
10~15d

3.2

4-1

4-2




A
B
…

15%~20% 155 ~170 6 bar

4-3

301940f3TCH0 1 Tę9856.7 7.985170402 493.7 Tc <0Ą4210b7(40 1 Tf 12 0 0 12 56.7 755

NaOH Na_2CO_3

H_2S

3

60%~70% 90%~95%

90%~95%

4.3

90%~95% 1

Nm^3 1.5~2.2 kWh 40%~50%

5

5.1

1

10% 2~3

2

24h

3

7

GB 50058

8

9

GB 50016 GB 50160

6

6.1

300~2000 mg/L 70~200 mg/L

SO_2 NO_x

7

20~40 /t 80%

60~120 /t 80%

0.05~0.10 /t

1

55

2

3

3

1~2 m 3~5 m

5° 2~3 m

4

3.3

1 **–**

40~50 m^3/h

2 **–**

4.5~5.0 m/min 1.5~2.0 m

–

3

250~300 m^3/h 5 m

2 m 1.5 m/min

4.5~5.0 m/min

4

5

6

NH_3 H_2S NH_3

H_2S

7

3.4

CO_2

1.5~2.5 m 4~7 m

4

C/N

≤

20 mm 55%~60% ≥ 35% C/N 20:1~30:1 pH 6.0~8.0

C/N

4.2

1

2

5%

3.0 m

2 m

C/N

3

5% 55 6d 7d

4-2

4-2

	95% 0.01
	0.2 O_2% /min ~0.3 O_2% /min
	45%
	60%

4.3

45 30~50d

4-3

4-3

	0.1 O_2% /min
	45%
	80%

5

1

H_2S NH_3

CO_2 CO NO_x

H_2S NH_3 GBZ1

GBZ2 GB 14554

2

12h

30d

6

25~45 / t

80% · d

120~160 / t

80%

150~200 m^2/ t 80%

1

2

3

3.1

4-5

4-5

3.2

1

2

1

40 s3f1T0 1 5d0f5f1T0lc05 TD5d>2D<0107>Tj TT3582 Tr0

v v ´

65 <10%

15%~40%

15% 3~5 mm

1000 kg/h

30 t/d 80%

5000 kg/h 150 t/d 80%

3

<80 <10% 150 ~220

10 mm

8000 kg/h 240 t/d

80%

4

105

100 <10% 200 ~300

30

1000~7500 kg/h 30~225

t/d 80%

5

100 ~40

<5% 250 ~300

30%~40% 1~5 mm

3000~10000 kg/h

90~300 t/d 80%

30~150μm

400 ~500 70 ~90 70

20~120 μm

5~12000 kg/h 360 t/d

4

4.1

1

2

3

5%

10% 60 g/m^3 110

4 1 50

5

6

4.2

GB 8978

GB 14554

GB 3096

GB 12348 GBJ 87

5

10~20 /t 80%

30~40 /t 80%

4-4

4-4

	720 kcal/kg	100~200 kWh/t
	760 kcal/kg	50~55 kWh/t
	688 kcal/kg	50~80 kWh/t
	688 kcal/kg	50~60 kWh/t
	690 kcal/kg	50~60 kWh/t
	850 kcal/kg	80~100 kWh/t

1

1 pH

pH ≥ 12

2 5 ~30 80

74.0 ~48.2

3

4

2

3

3.1

4-6

3.2

1

2

3

4

30 ~50

4

1

30

4-5

4-5 **pH** 22.7%

	%	30	%		pH
			50		
1	2	28	30.8	33.1	12.5
2	4.6	30	35.9	38.0	12.6
3	6.9	43	39.2	41.4	12.6
4	9	45	48.1		12.6
5	11	58	51.7		12.6
6	14.4	59	54.8		12.6

2

–

5~10d

5

2~4 /t 80%

50~150

70 ~90

1

2

1

2

3

1

$N+P_2O_5+K_2O$ 20 g/kg 200 g/kg

40 g/kg

240 g/kg 30 g/kg

200 g/kg

2

CJ/T309

A B A

B

GB/T 23486

CJ/T 291

3

10 mm 5 mm

0.8 g/cm^3 60% 40%

3 ms/cm pH 6.0~8.0

4

60% 50%

75%

5

95% 0.01

4

4.1

4.2

4.3

1

¿ Ó - ®

4~8 kg/m^2 Ṛ Ṛ

30~40d

2

50%~70%

3

4~8 kg/m^2 8~10 kg/m^2

4

6~8 kg/m^2

5

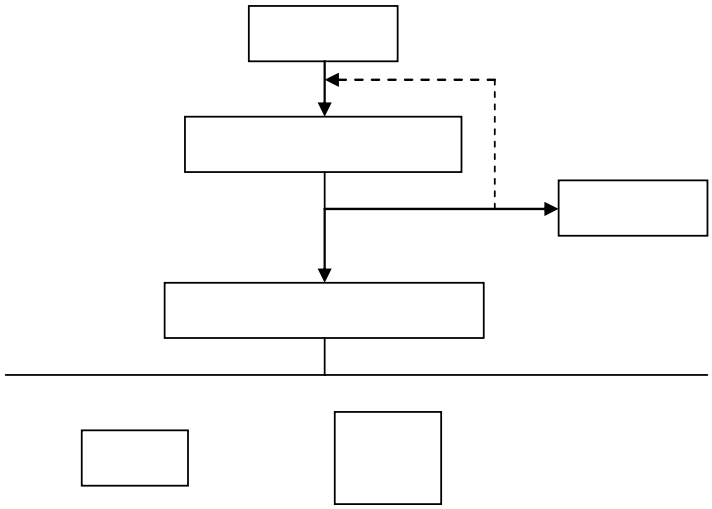
5~10 kg/m^2 12 kg/m^2

6

3 kg/m^2

5

5-1



5.2

50 ~60

55 5~7d

5.3

5.4

NaCl 20~40

5.5

1km

5.6

15° 15°

5.7

6

COD α

PAHs

5.8

1

1.1

2

1

$Q_{ad,net}$ kJ/kg M_{ar} %

5-1

$$Q_{ar,net} = (Q_{ad,net} + 23M_{ad})\frac{100 - M_{ar}}{100 - M_{ad}} - 23M_{ar} \qquad 5\text{-}1$$

$Q_{ar,net}$—— M_{ar}% kJ/kg

$Q_{ad,net}$—— kJ/kg

M_{ad}—— %

M_{ad}=0

2

5-2

$$A_2 = A_1 \cdot \frac{100 - M_1}{100 - M_2} \qquad 5\text{-}2$$

A_1—— kg/h

M_1—— %

A_2—— kg/h

M_2—— %

3

5-3

$$q_{gh} = (A_1M_1/100 - A_2M_2/100) \cdot \frac{C_v \cdot (T_2 - T_1) + r_{T_2}}{\eta_{gh}/100}$$

q_{gh}—— kJ/h

C_v—— 4.187 kJ/ kg¶

T_1—— 20

T_2—— 100

r_{T_2} ——T_2 2261 kJ/kg

η_{gh} —— %

4

5-4

$$q_{gl} = A_2 \cdot Q_{2,ar,net} \cdot \eta_{gl} / 100$$ 5-4

q_{gl}—— kJ/h

A_2—— kg/h

$Q_{2,ar,net}$ ____ kJ/kg

η_{gl} ____ %

q_{gl} > q_{gh}

q_{gl} < q_{gh} q_{gh} q_{gl} kJ/h

80% 40%

85% 13510 kJ/kg 3227 kcal/kg

5

1

NO_x SO_2 ŧ #

2.2

2.3

2.4

60%~85%

1 2

3 4

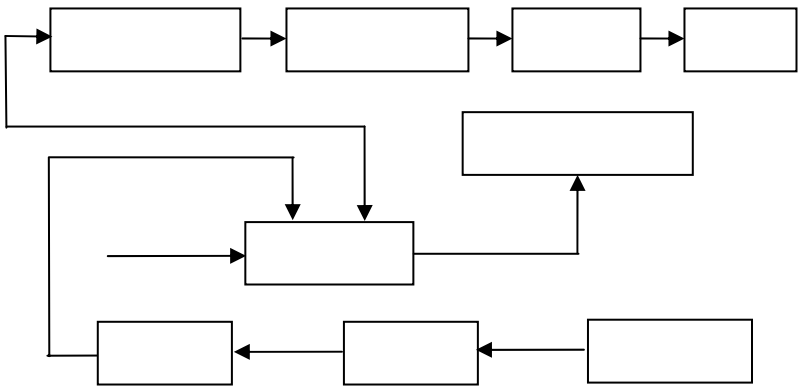
80%

40%

3.4

1

5-3



5-3

2

850

3.5

1

5-4

5-4

2

40%

850

3.6

40%

3

GB 5085

4

GB 8978

5

GB 3096

GB 12348 GBJ 87

3.7

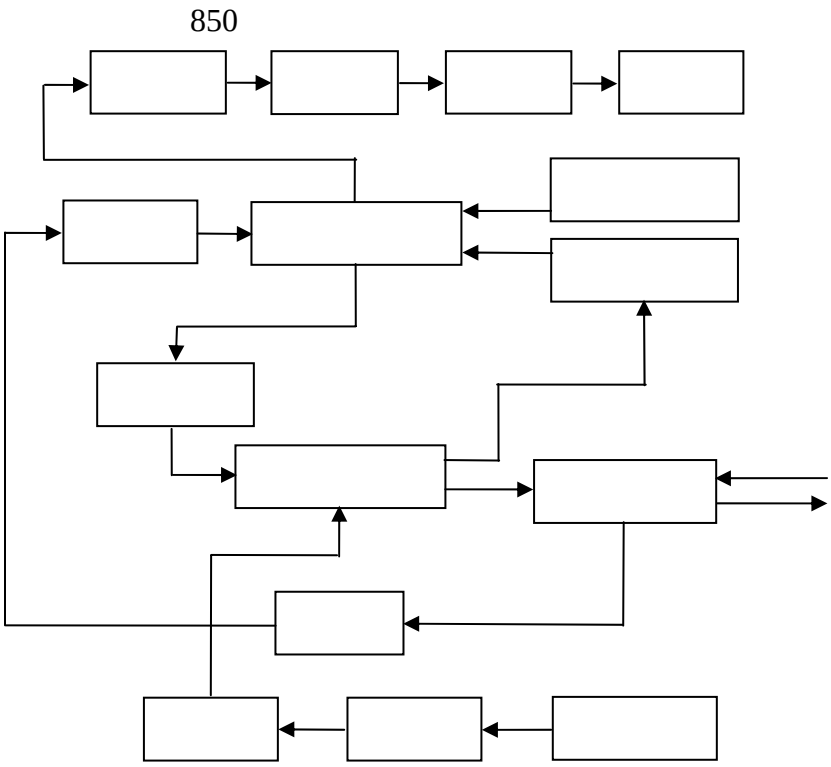
4.2

4.3

1

5-5

2



5-5

4.4

1

GB 14554

2

GB 18485

3

GB 18485

4

GB 8978

5

GB 3096

GB 12348 GBJ 87

4.5

10~15 / t

80% 30~40 / t 80%

100~180 / t 80%

55~60kWh/ t 80%

	ug/L		
Cu	50	100	300
Zn	50	100	300
Ni	4	50	200

5-3

	≤ 3	≤ 2
	≤ 1	≤ 0.5
	≤ 5	
	≤ 5	
SO_3	≤ 1.0	
		GB/T 17431.2 19.6.3
%	≤ 0.02	
	GB6566	

1.3

1

5-4

5-4

	SiO_2	Al_2O_3	Fe_2O_3	CaO+MgO	K_2O+Na_2O
	48~79	8~25	3~12	1~12	0.5~7

$$\frac{SiO_2 \quad Al_2O_3}{F_{2\ 3} \qquad\qquad\qquad\qquad 2 \qquad 2}$$

→ → → → → → → → → → →

→

3

80% 80%

30%

1100 ~1200

1.4

GB 18485

1.5

30

250~300 /m^3 5%~10%

1100

3

Ý · ²0 @

1.5

! ± ´ ف ف

4d

2

2.1

GB/T 23485 GB 16889

2.2

1.0 kg/m^3

20~30 cm

1.0×l0^{-7} cm/s 20~30 cm 20~30 cm

20 cm 80 cm

5%

CJJ 17

3

3.1

GB/T 23485 GB 16889

5-5

1

1

2

5~7 d ض ّ

5

6

2.2

1 0.5m

2

3

4

5

6

5

1

1.1

1

2

3

180

1.2

1

60

2

3

2

2.1

3

100 m 300 m

300 m

1

2 CJJ 27

3 GB 50014

4

5 AQ 3028

6 GB 50058

7 GB 50160

8 GB 7959

9 GBZ1

10 GBZ2

11 GB 14554

12 GB 8978

13 GB 3096

14 GB 12348

15 GB 16889

16 CJJ 17

17 GB 18918

18 [2001]101

19 GB 18485

20 GB 5085

21 GB 4915

22 GB 18484

23 2000/76/EC

24 GB/T 17431.1

25 GB 5101

26 GB 13544

27 GB 13545

CJJ/T 80

CJ/T 3073

GB 18598

GB 5750

HJ/T 164

GB 15618

HJ/T 166

GB 2893

GB 2894

GB 13223

CJ 3082

GB24188

GB/T 23486

GB/T 23485

GB24602

GB24600

CJ/T289

CJ/T309

GB 50016

GB/T23484