

城镇污水处理厂污泥处理处置技术指南

中华人民共和国住房和城乡建设部
中华人民共和国国家发展和改革委员会

二〇一一年三月

前 言

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第一章 总 则

1

2

3

4

“ ”

5

第二章 污泥的来源与性质

1

m³ 80% 5~10 t

2

2.1

97 ~98
99.2 ~99.8 94 ~96
80%
m/kg
20~60 × 10¹² m/kg 100~300 × 10¹² m/kg
40~80 × 10¹² m/kg 1 × 10¹¹ m/kg 1 × 10¹³ m/kg

2.2

50 ~70 60 ~85 30 ~50

2-1

2-1 %

	TN	P ₂ O ₅	K
	2.0~3.4	1.0~3.0	0.1~0.3
	3.5~7.2	3.3~5.0	0.2~0.4

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

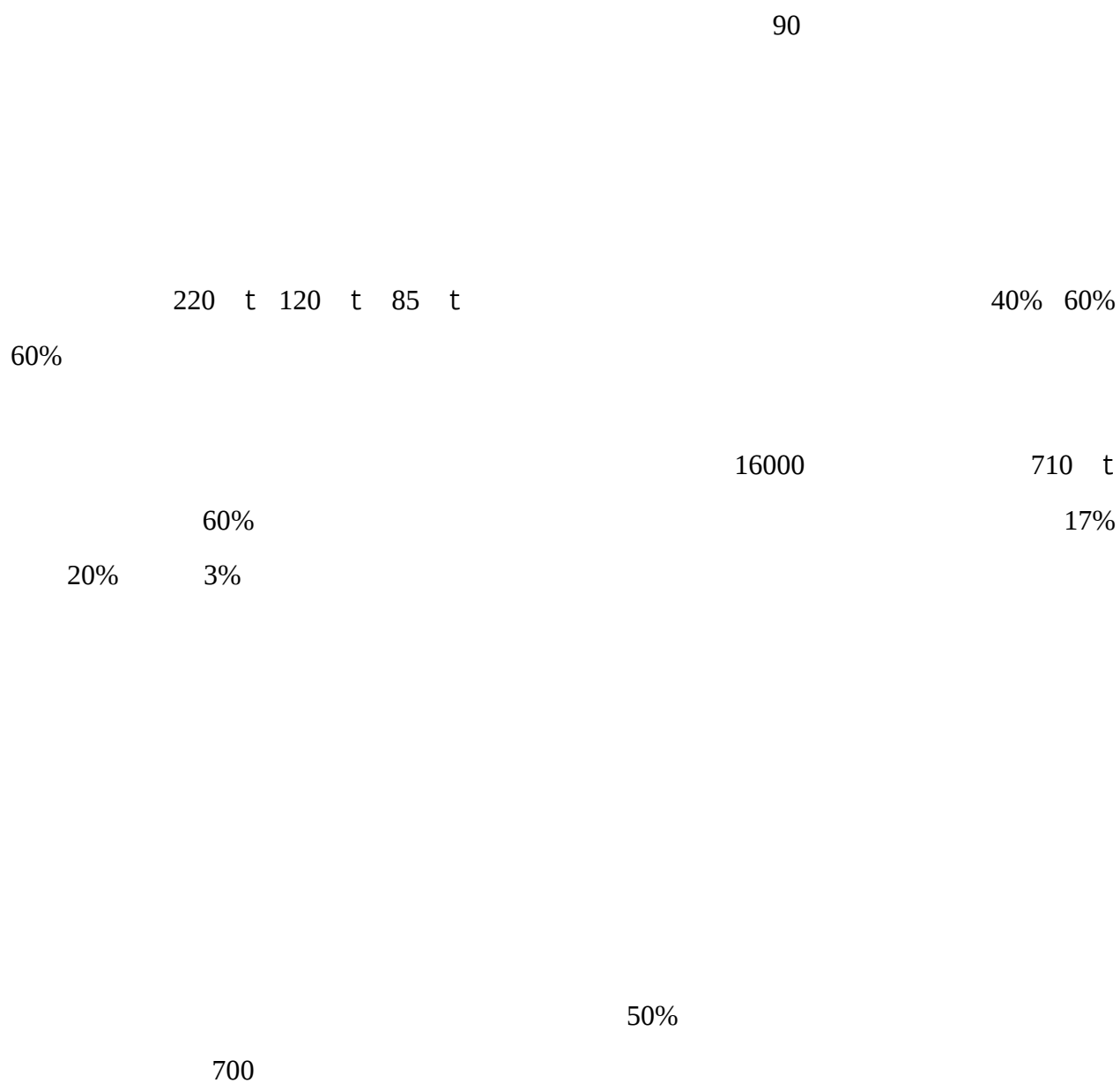
2-4

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%

第三章 污泥处理处置的技术路线与方案选择

1



2

2009

1992

280 m³

80%

2005 t

3000 t

1

“

”

3

5

1

1.1

GB/T24600

GB/T

23486

CJ/T 309

GB 15618

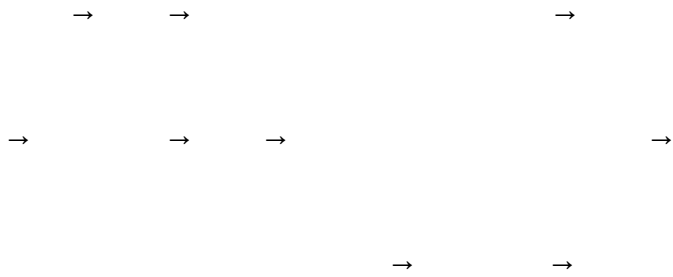
1.2

1.3

GB/T 23485

2

2.1



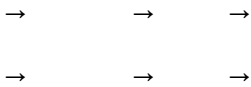
2.2



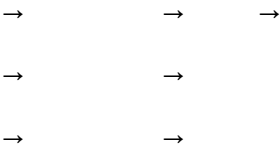
2.3



2.4



2.5



@ ÖÛä º1P |ó Đ” \$ `ÌÀ 1 đPQ PUÑ Pk0 • Ü] œ ‹

2.5



3

3-1

Inventories Vol 5 Waste

400~600

kg

IPCC

3-2

3-2

+			
+			
+			
+			
+			

第四章 污泥处理的单元技术

1

94 ~96

80

2

3

3.1

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

2.0~4.0 kg/m³·d

35 ±2

35 ~45

20d

0.75~1.10 N m³/kgVSS

2

55 ±2

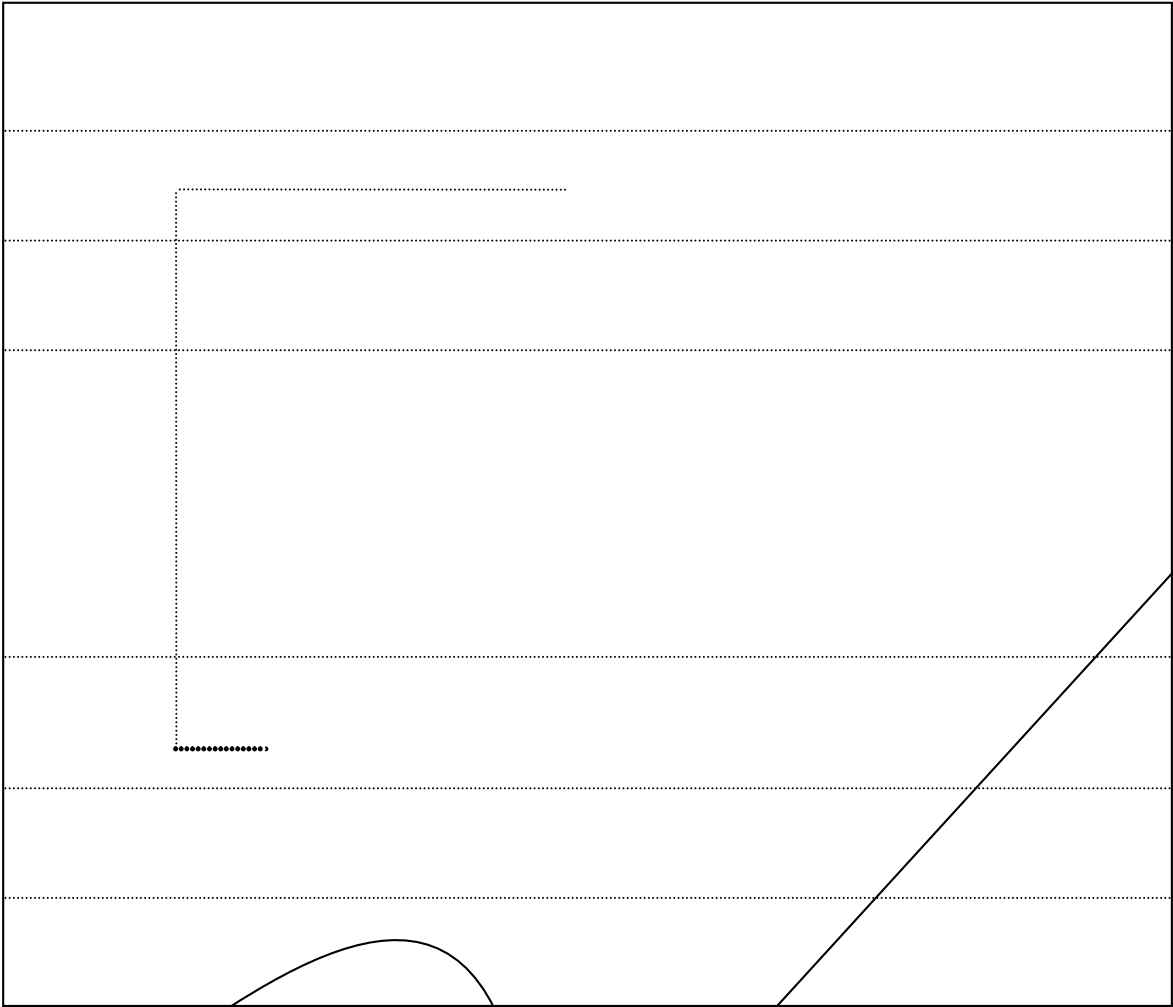
35%~45%

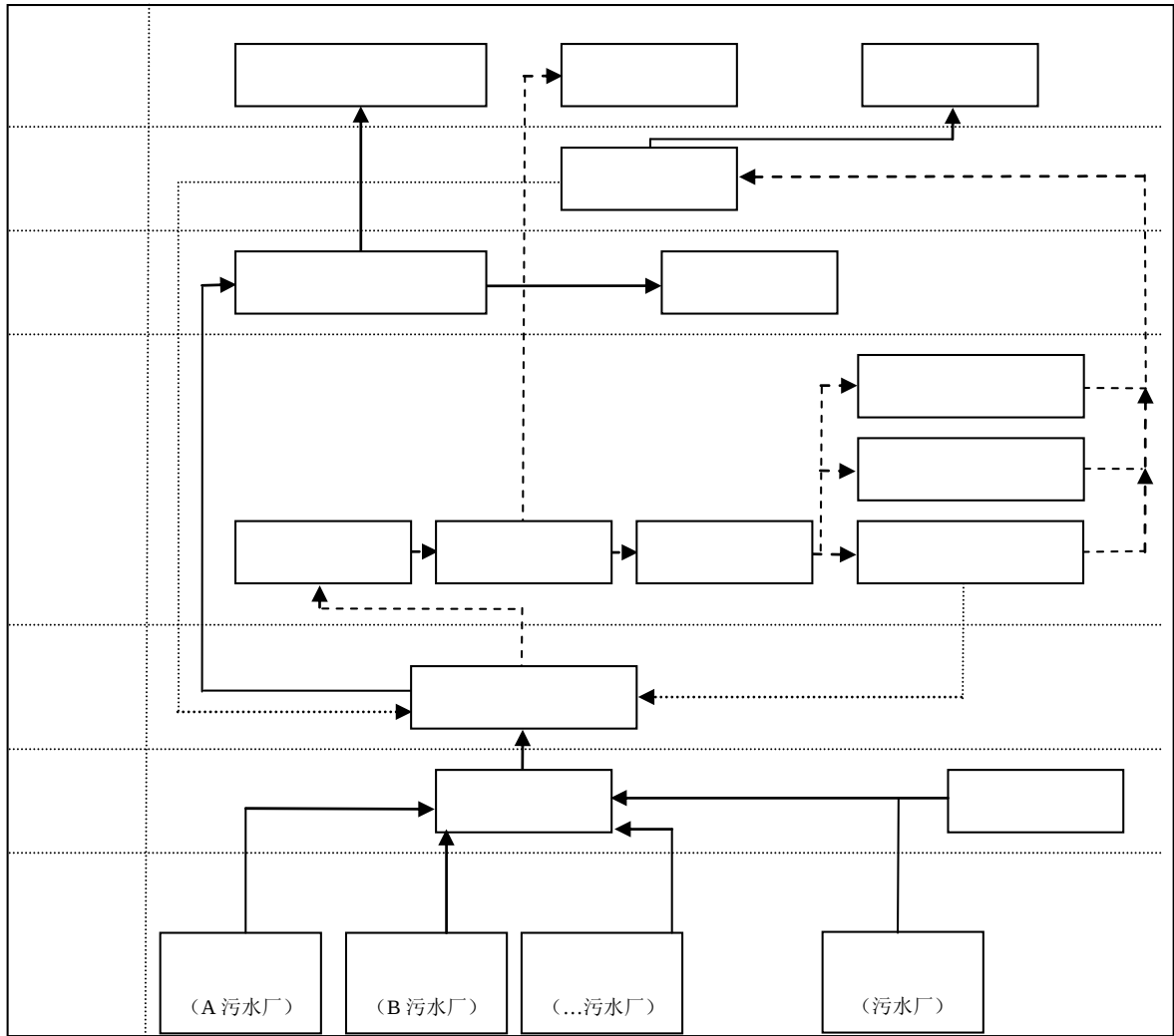
10~15d

3.2

4-1

4-2





4-2

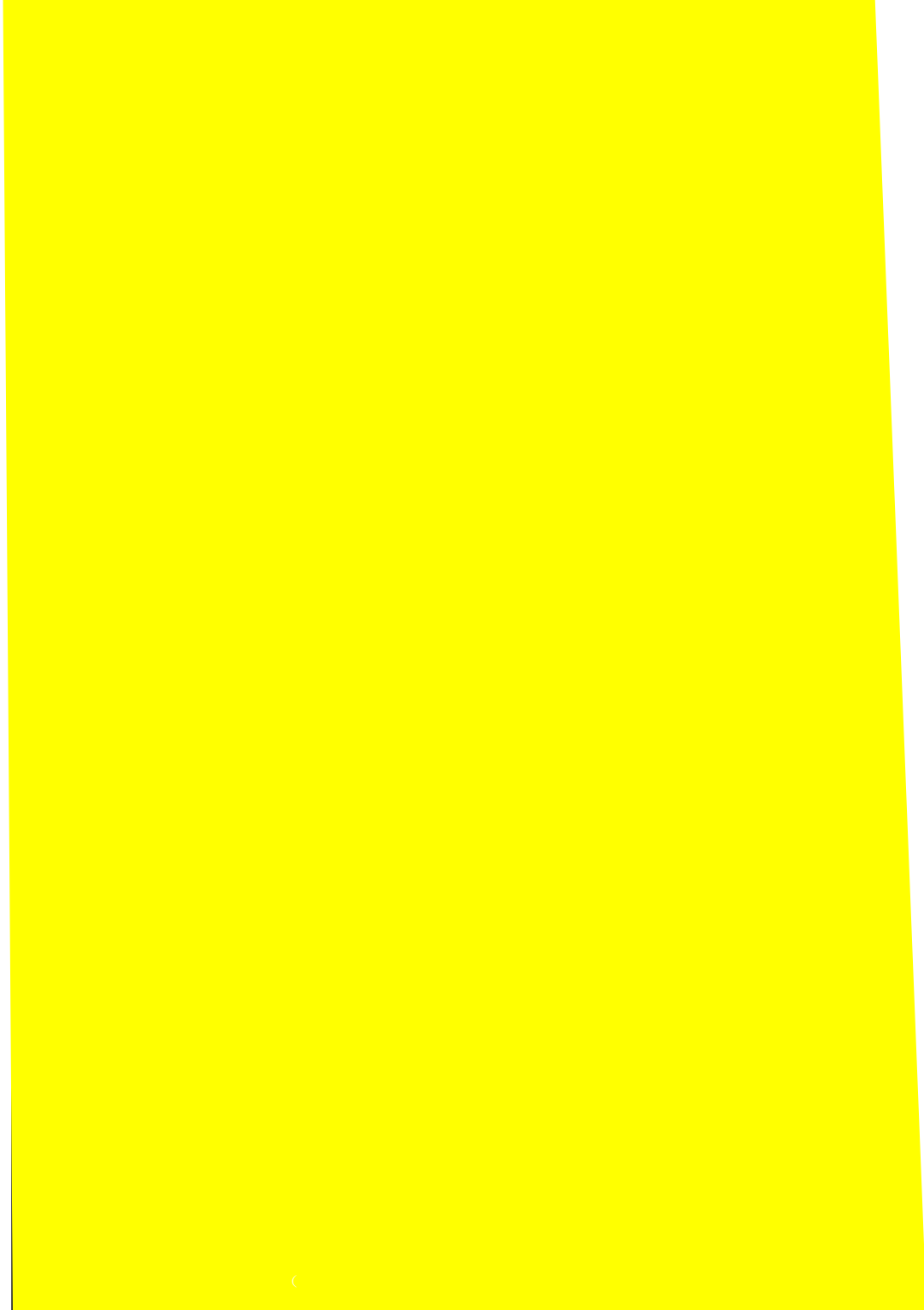
3.3

1

THP

Thermal Hydrolysis Pre-Treatment

bar



“ ”

4

4.1

	CH ₄	CO ₂	H ₂ S	60%~70%
CO ₂	30%~40%	H ₂ S	0.1~10g/Nm ³	
	21000~25000 kJ/Nm ³		5000~6000 kcal/m ³	6.0~7.0 kWh/Nm ³

4.2

1

~10bar

30~50mbar

6~24h

2

NaOH Na₂CO₃
H₂S

3

60%~70%

90%~95%

90%~95%

4.3

90%~95%

1

Nm³

1.5~2.2 kWh

40%~50%

5

5.1

1

10%

2~3

2

24h

3

2

±1

4

2000~5000 mg/L

500 mg/L

5 pH

pH

6.0~8.0

pH

6.8~7.2

pH

6.0

8.0

pH

6

H₂S

5.2

H₂S

1

CH₄

5%~14%

2

CH₄/CO₂

3

AQ 3028

4

5

6

7

GB 50058

8

9

GB 50016

GB 50160

6

6.1

300~2000 mg/L

70~200 mg/L

6.2

S^{2-}

CO_3^{2-}

6.3

SO₂ NO_x

7

20~40 /t

80%

60~120 /t

80%

0.05~0.10 /t

1

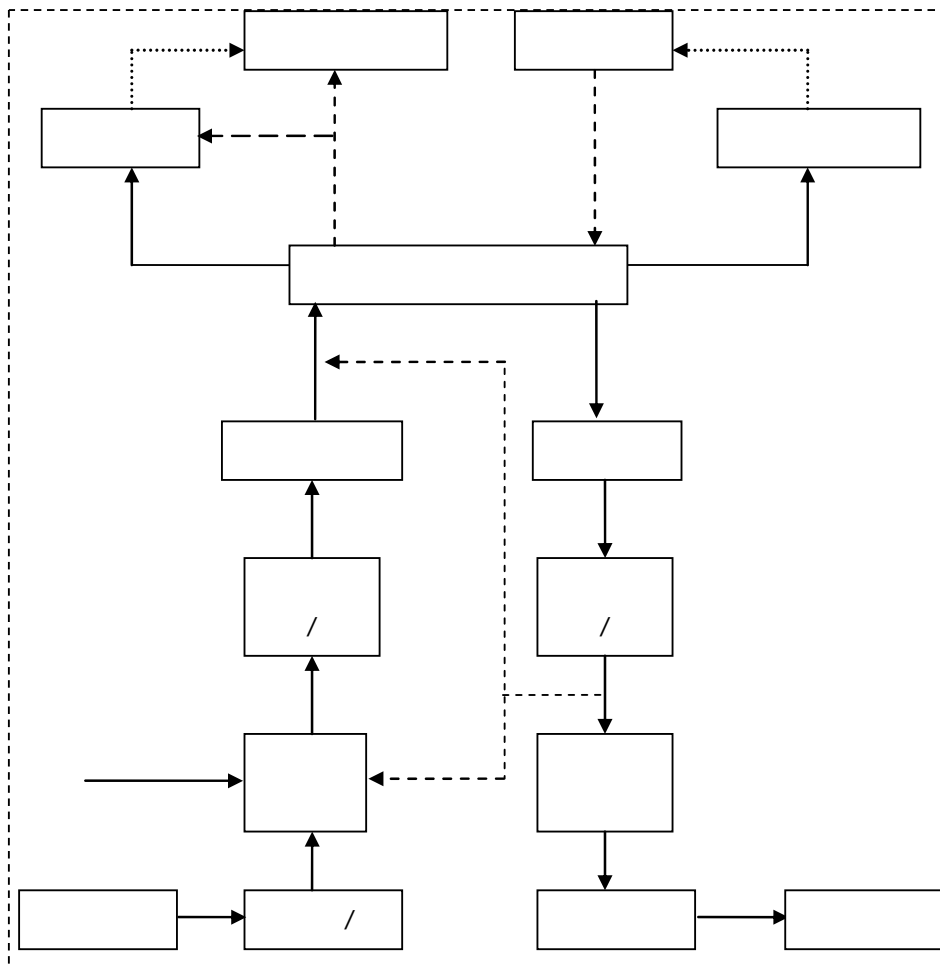
55 °C

2

3

3.1

4-4



4-4

3.2

1

2

3

1~2 m

3~5 m

5°

2~3 m

4

5

>70

3.3

1 —

40~50 m³/h

2 —

4.5~5.0 m/min 1.5~2.0 m

—

3

250~300 m³/h 5 m

2 m 1.5 m/min

4.5~5.0 m/min

4

5

6

H_2S NH_3 H_2S NH_3

7

3.4

CO_2

1.5~2.5 m 4~7 m

4

4.1

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 °C

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

H₂S NH₃

CO₂ CO NO_x

H₂S NH₃

GBZ1

GBZ2

GB 14554

2

12h

30d

6

25~45 / t

80% · d

120~160 / t

80%

150~200 m²/ t 80%

1

2

3

3.1

4-5

4-5

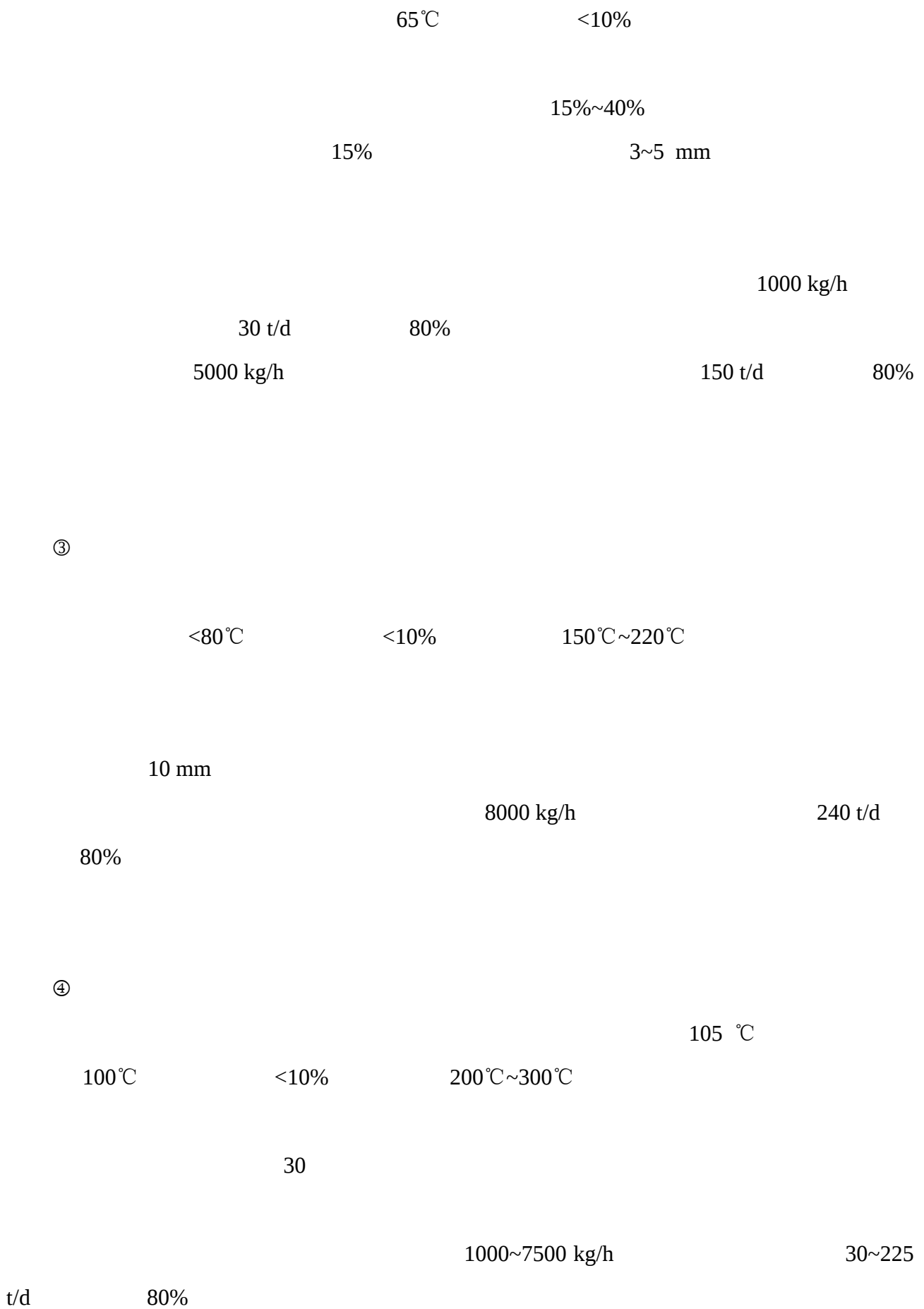
3.2

1

2

①

40℃~d0.0 TD Tfd Tf32b Tfc050 TT20107>TjTT3 1 58Tr0.5



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

80%

m

4

4.1

1

2

①

②

③

④

⑤

⑥

3

5%

10%

60 g/m³

110 °C

4

1

50 °C

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

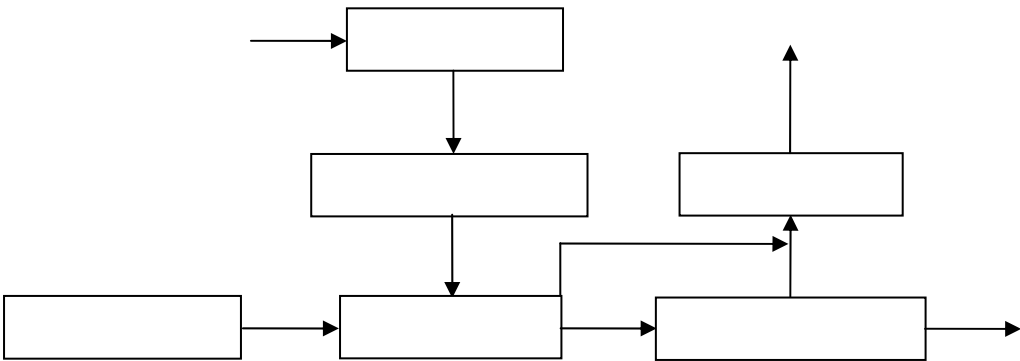
3

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%

	%	℃	%		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

噫

2

第五章 污泥处置方式及相关技术

1

2

3

1

N+P₂O₅+K₂O

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/cm³

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

4~8 kg/m²

30~40d

2

50%~70%

3

4~8 kg/m²

8~10

kg/m²

4

6~8 kg/m²

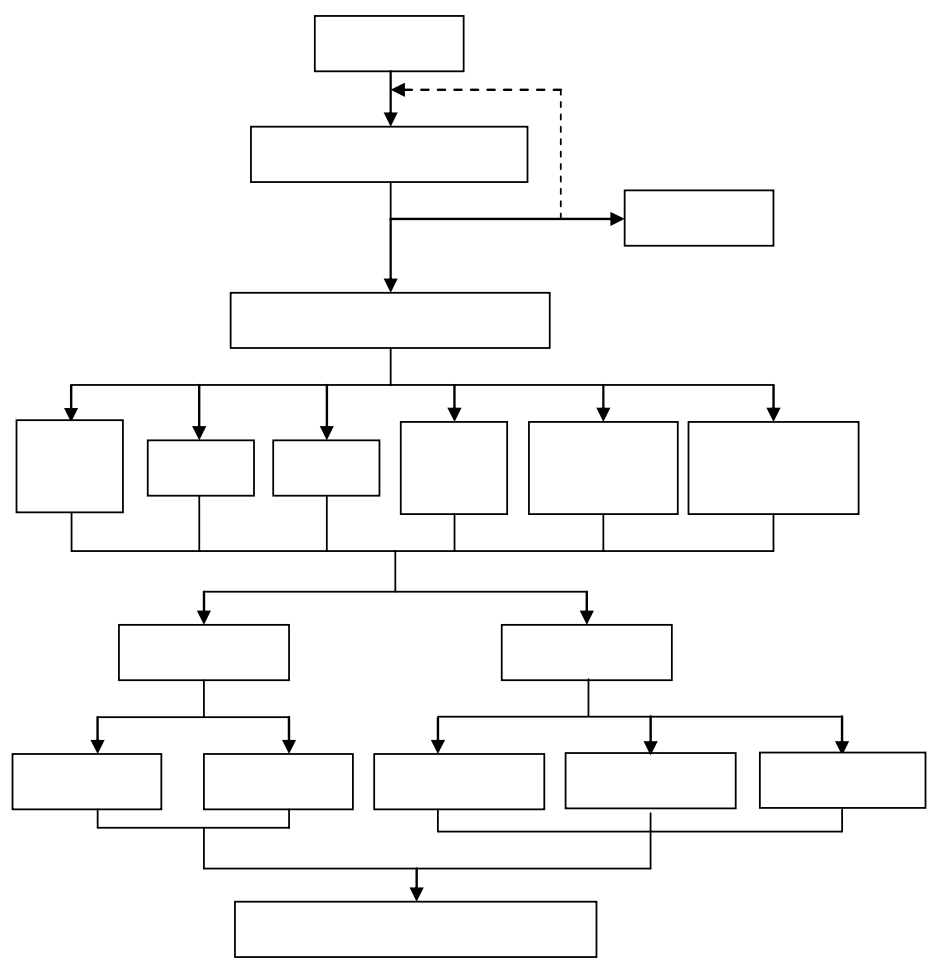
5

5~10 kg/m²

12 kg/m²

6

3 kg/m²



5-1

5.1

50%

PCBs

OCPs

PAHs

5.2

50 ~60

55 5~7d

5.3

5.4

NaCl 20~40

5.5

1km

5.6

15° 15°

5.7

1

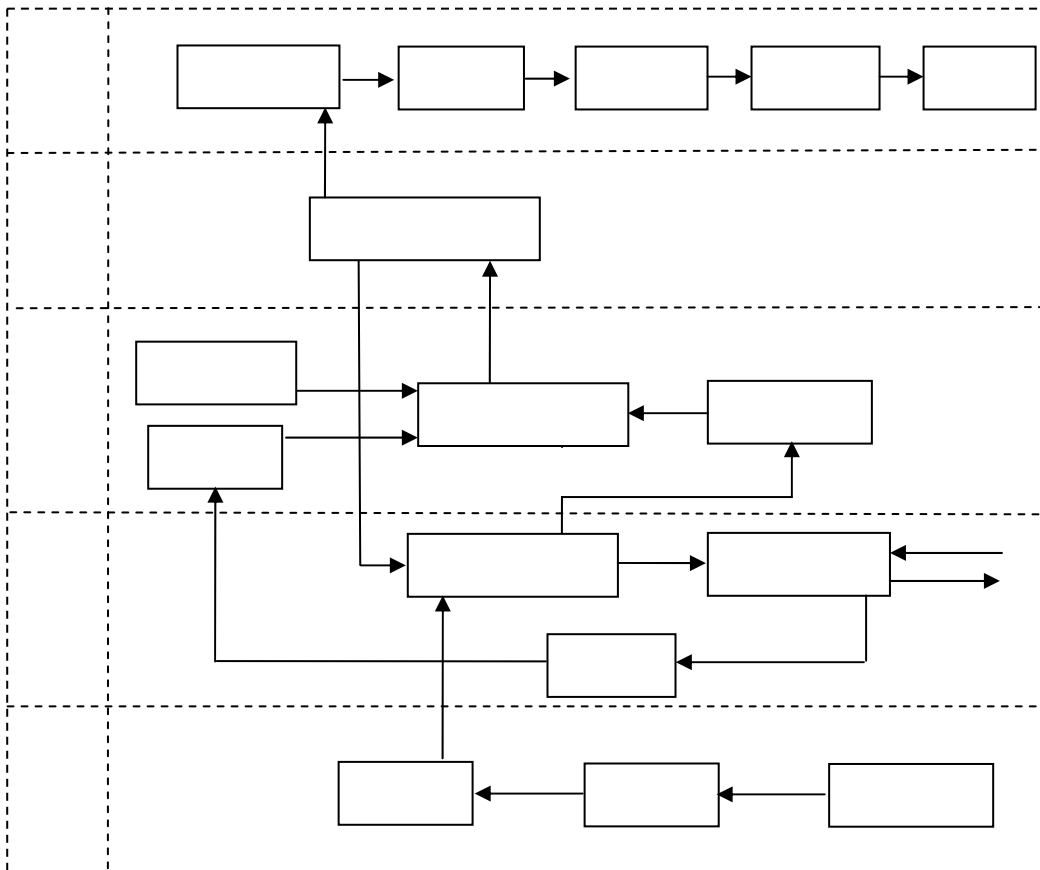
1.1

1.2

1.3

1

5-2



5-2

2

180 °C 65%~125% 2 1 850°C~950°C 3

1.4

1

$Q_{ad, net}$ kJ/kg

M_{ar} %

5-1

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

$Q_{ar, net}$ — M_{ar} % kJ/kg

$Q_{ad, net}$ — kJ/kg

M_{ad} — %

$M_{ad}=0$

2

5-2

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

A_1 — kg/h

M_1 — %

A_2 — kg/h

M_2 — %

3

5-3

$$q_{gh} = (A_1 M_1 / 100 - A_2 M_2 / 100) \cdot \frac{C_v \cdot (T_2 - T_1) + r_{T_2}}{\eta_{gh} / 100} \quad 5-3$$

q_{gh} — kJ/h

C_v — 4.187 kJ/ kg, °C

T_1 — 20 °C

T_2 — 100 °C

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

$$q_{gl} \text{ ————— } \text{kJ/h}$$

$$A_2 \text{ ————— } \text{kg/h}$$

$$Q_{2,ar,net} \text{ ————— } \text{kJ/kg}$$

$$\eta_{gl} \text{ ————— } \%$$

$$q_{gl} > q_{gh}$$

$$q_{gl} < q_{gh} \quad q_{gh} \quad q_{gh} - q_{gl} \quad \text{kJ/h}$$

80%

40%

85%

13510 kJ/kg

3227

kcal/kg

5

1.5

1

2

10

3

4

5

6%~10%

6

850℃~950℃

7

180

℃

1.6

CJ/T 290

1

NO_x SO₂

噫

SO₂

“ + ”

噫

噫

“3T” Turbulence Temperature Time

3 s

噫

噫

噫

NO_x

SNCR

30%~70%

GB 18485

2

GB 5085.1-3

2.2

2.3

2.4

60%~85%

1

2

3

4

5

5%~10%

2.5

2.6

2.7

GB 18485

3

3.1

3.2

35 t/h

8%

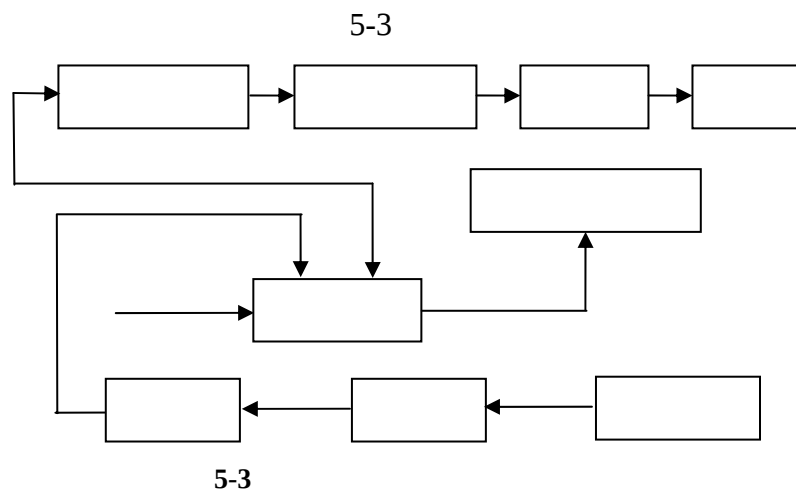
3.3

80%

40%

3.4

1



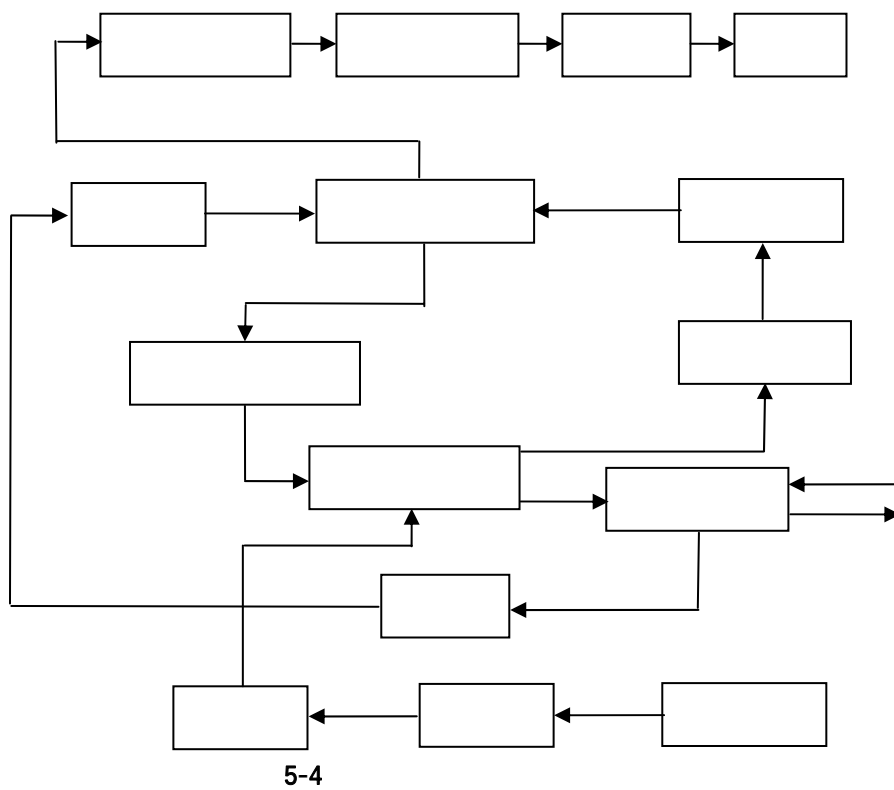
2

850°C

3.5

1

5-4



2

40%

850 °C

3.6

CJ/T 290

1

GB 14554

2

噫

3

GB 5085

4

GB 8978

5

GB 3096

GB 12348

GBJ 87

3.7

10~15

/ t

80%

30~40

/ t

80%

100~180 / t

80%

55~60 kWh/

80%

4

4.1

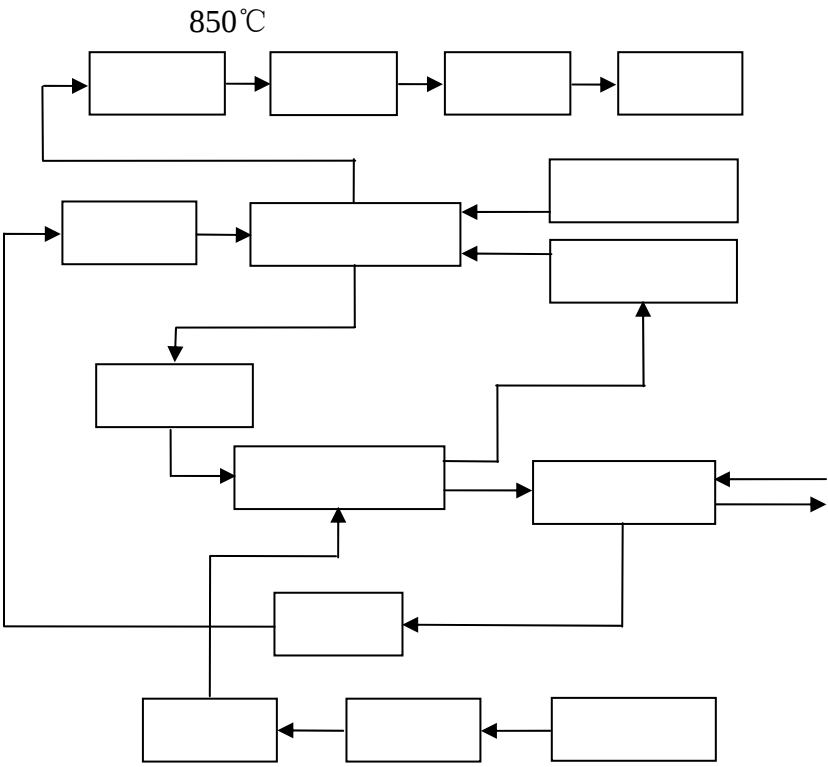
4.2

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%

ó

"

	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 ₂ O ₃	Fe ₂ O ₃	CaO+MgO	K ₂ O+Na ₂ O
	48~79	8~25	3~12	1~12	0.5~7

$$\frac{SiO_2 + Al_2O_3}{Fe_2O_3 + CaO + MgO + FeO + Na_2O + K_2O} \quad 3.5\sim 10$$

CJ/T 289

2

→ → → → → → → → → → →

→

3

80%

80%

30%

1100℃~1200℃

1.4

GB 18485

1.5

30

250~300 /m³

5%~10%

1

≤ 8%

4d

2

2.1

GB/T 23485

GB 16889

2.2

1.0 kg/m³

20~30 cm

1.0×10⁻⁷ 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		45
2		2
3		5 / .
4		25 kN/m ²

5-5

GB 18918

3.2

1

2

20

cm

1000 kg/m³

3

4 d

50 kPa

4

5

CJJ 17

4

16~26 /m³

20

18 / t

70~80 / t

50 km

100~125 / t

第六章 应急处置与风险管理

1

1

2

5~7 d

GB/T 23485

CJ/T 290

1

2

2

2.1

1

0.5m 3~ m

2

3

4

1~2 cm

5

6

2.2

1

0.5m

2

3

4

5

6

7

3

3.1

1

2

5~10 cm

3

1~2 mm

4

5~7 d

60%

5

3~5 cm

6

3.2

1

2

3

4

5

1

1.1

1

2

3

180 °C

1.2

1

60 °C

2

3

“ ”

GB 50016

2

2.1

3

100 m

300 m

300 m

编制依据

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

28		CJJ/T 80
29	CJ/T 3073	
30		GB 18598
31		
32		
33		
34	GB 5750	
35		HJ/T 164
36	GB 15618	
37		HJ/T 166
38	GB 2893	
39	GB 2894	
40		GB 13223
41		CJ 3082
42		GB24188
43		GB/T 23486
44		GB/T 23485
45		GB24602
46		GB24600
47		CJ/T289
48		CJ/T309
49	GB 50016	
50		GB/T23484

