

Construction of a Green-Comprehensive Evaluation System for Flotation Collectors

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Table S1. Physical and chemical hazard index weight determination table

B ₁	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₇	C ₈	C ₉	C ₁₀	Weight
C ₁	1	1/2	3	5	5	4	1/2	1/2	1/5	1/4	0.0772
C ₂	2	1	4	5	5	4	1/3	1/3	1/6	1/5	0.0808
C ₃	1/3	1/4	1	2	3	3	1/4	1/4	1/6	1/5	0.0407
C ₄	1/5	1/5	1/2	1	2	2	1/5	1/4	1/5	1/4	0.0309
C ₅	1/5	1/5	1/3	1/2	1	1/2	1/4	1/5	1/6	1/5	0.0216
C ₆	1/4	1/4	1/3	1/2	2	1	1/3	1/5	1/6	1/5	0.0267
C ₇	2	3	4	5	4	3	1	1/2	1/3	1/2	0.1170
C ₈	2	3	4	4	5	5	2	1	1/2	1/2	0.1473
C ₉	5	6	6	5	6	6	3	2	1	2	0.2626
C ₁₀	4	5	5	4	5	5	2	2	1/2	1	0.1952

Table S2. Stability and reactivity index weight determination table

B ₂	C ₁₁	C ₁₂	C ₁₃	C ₁₄	Weight
C ₁₁	1	1/7	1/2	1/4	0.0655
C ₁₂	7	1	5	3	0.5731
C ₁₃	2	1/5	1	1/3	0.1082
C ₁₄	4	1/3	3	1	0.2532

Table S3. Table for determining the weight of environmental impact indicators

B ₃	C ₁₅	C ₁₆	C ₁₇	C ₁₈	Weight
C ₁₅	1	5	7	8	0.6528
C ₁₆	1/5	1	2	3	0.1655
C ₁₇	1/7	1/2	1	2	0.1081
C ₁₈	1/8	1/3	1/2	1	0.0736

Table S4. Weight determination table of health impact indicators

B ₄	C ₁₉	C ₂₀	C ₂₁	C ₂₂	C ₂₃	C ₂₄	C ₂₅	Weight
C ₁₉	1	2	4	5	6	8	3	0.3421
C ₂₀	1/2	1	3	4	5	7	2	0.2353
C ₂₁	1/4	1/3	1	3	4	6	1/2	0.1162
C ₂₂	1/5	1/4	1/3	1	2	5	1/3	0.0657
C ₂₃	1/6	1/5	1/4	1/2	1	6	1/7	0.0444
C ₂₄	1/8	1/7	1/6	1/5	1/6	1	1/8	0.0198
C ₂₅	1/3	1/2	2	3	7	8	1	0.1765

Table S5. Determination table of weight of drug effect index

B ₅	C ₂₆	C ₂₇	C ₂₈	Weight
C ₂₆	1	2	3	0.5396
C ₂₇	1/2	1	2	0.2970
C ₂₈	1/3	1/2	1	0.1634

Table S6. Industrial analysis and elemental analysis of long flame coal

Industrial analysis (%)				Elementary analysis (%)				
M _{ad}	A _d	V _{daf}	FC _{daf}	C _d	H _d	N _d	O _d	S _{t, d}
6.04	30.56	38.75	61.25	54.08	3.27	0.93	10.80	0.36

Table S7. Collector list

Collector	Performance specification	Molecular formula
N-octane	AR	C ₈ H ₁₈
Dodecane	AR	C ₁₂ H ₂₆
1-octanol	AR	C ₈ H ₁₈ O
2-octanone	Content > 98 %	C ₈ H ₁₆ O
Valeraldehyde	Content > 98 %	C ₅ H ₁₀ O
Dodecyl aldehyde	Content > 98 %	C ₁₂ H ₂₄ O
Methyl laurate	Content > 98 %	C ₁₃ H ₂₆ O ₂

Table S8. Experimental results of coal slurry flotation with different collectors

Collector	Collector dosage/ (kg/t)	Cleaned coal /%		Tail coal /%		Flotation perfection index/%	Combustible recovery /%
		productivity	Ash	productivity	Ash		
Dodecane	8.0	45.41	13.82	54.59	40.58	26.88	53.30
N-octane	1.0	32.49	14.05	67.51	37.56	19.50	38.25
Dodecyl aldehyde	1.0	57.05	14.22	42.95	48.75	32.73	66.55
Methyl laurate	1.0	54.26	14.19	45.74	46.96	31.98	63.68
1-octanol	2.0	36.48	13.79	63.52	38.20	21.80	42.83
2-octanone	2.0	32.05	13.92	67.95	36.42	19.38	37.77
Valeraldehyde	4.0	38.24	14.99	61.76	38.41	21.85	44.79

Table S9. Collector flotation test data index table

Flotation test Tertiary index	Dodecane	Dodecyl aldehyde	Methyl laurate	N-octane	1-octanol	2-octanone	Valeraldehyde
C ₂₆	45.41	57.05	54.26	32.29	36.48	32.05	38.24
C ₂₇	53.30	66.55	63.68	38.25	42.83	37.77	44.79
C ₂₈	26.88	32.73	31.98	19.50	21.80	19.38	21.85
C ₂₉	5.00	50.00	18.00	10.00	10.00	15.00	15.00
C ₃₀	8.00	1.00	1.00	1.00	2.00	2.00	4.00

Table S10. Weight determination table of three index of flotation collector

comprehensive evaluation system based on flotation test

B	B ₁	B ₂	B ₃	B ₄	B ₇	B ₈	Weight
B ₁	1	2	1/3	1/4	1/5	1/2	0.0651
B ₂	1/2	1	1/2	1/5	1/6	1/3	0.0483
B ₃	3	2	1	1/2	1/3	2	0.1445
B ₄	4	5	2	1	1/2	3	0.2547
B ₅	5	6	3	2	1	4	0.3854
B ₆	2	3	1/2	1/3	1/4	1	0.1022

Table S11. Green data index of collector

Green index	Dodecane	Dodecyl aldehyde	Methyl laurate	N-octane	1-octanol	2-octanone	Valeraldehyde
C ₁	-9.6	44.5	5.2	-56.8	-15.5	-16	-91.5
C ₂	216	185	267	126	195	174	103
C ₃	6.1	4.989	5.41	5.18	3	2.37	1.31
C ₄	0.7487	0.835	0.865	0.703	0.829	0.82	0.811
C ₅	170.33	184.32	214.35	114.23	130.23	128.21	86.13
C ₆	1.45	3.62	4.85	0.55	4.5	4.4	3
C ₇	6.2	8.2	8.3	6.5	4.5	4.5	7.8
C ₈	0.6	1	1.3	0.8	0.8	1.2	2.1
C ₉	83	101	134	13	81	52	12
C ₁₀	203	200	298	206	253	231	222
C ₁₁	Yes	Yes	Yes	Yes	Yes	Yes	Yes
C ₁₂	1	1	3	1	3	3	4
C ₁₃	No	No	No	No	No	No	Yes
C ₁₄	2	2	2	2	2	2	2
C ₁₅	3	2	1	1	1	3	3
C ₁₆	3	2	2	1	1	3	3
C ₁₇	No	No	No	No	No	No	No
C ₁₈	1	3	4	1	3	1	3
C ₁₉	5	5	4	4	4	4	5
C ₂₀	2	2	2	2	3	2	2
C ₂₁	2B	2A	2B	2A	2A	2A	2A
C ₂₂	2	2	3	3	1	3	3
C ₂₃	1A	2	2	1A	2	2	2
C ₂₄	2	2	2	2	2	2	2
C ₂₅	1	2	2	1	2	2	2