ZESZYTY NAUKOWE POLITECHNIKI ŚLĄSKIEJ 1998
Seria: GÓRNICTWO z. 238 Nr kol. 1399

Peter FEČKO
VŠB Technical University Ostrava
Martin DROBÍK
OKD, a.s., Mine Lazy Orlova
Adriana STAHOVCOVÁ
VŠB -Technical University Ostrava

RE-FLOTATION OF BLACK COAL SLURRIES FROM SLURRIES PONDS OF MINE FRANTIŠEK, OKD, A.S.

Summary. The work presents possibility of the black coal slurries reflotation from slurries ponds of Mine František, OKD, a.s. Two collectors (Montanol and Flotakol NX) were tested and attention was paid to the influence of organic flocculants to quality flotation concentrates. The research results show that influence of organic flocculants is not significant on the contrary with their application better results were not achieved.

FLOTACJA WTÓRNA MUŁÓW WĘGLA KAMIENNEGO ZE STAWU OSADOWEGO KOPALNI FRANTIŠEK, OKD, A. S.

Streszczenie. Praca przedstawia możliwości wyflotowywania mułów węgla kamiennego ze stawu osadowego kopalni „František", OKD, a. s. Dwa zbieracze (Montanol i Flotakol NX) były badane pod kątem wpływu organicznych flokulantów na jakość koncentratu flotacyjnego. Wyniki badań pokazują, że wpływ organicznych flokulantów jest nieistotny i przy ich zastosowaniu nie osiągnięto lepszych wyników.

Introduction

There is necessity of the most perfect coal processing as also maximum utilisation of its combustible compounds at present because there is trend of total decrease of coal mining. The development of mineral processing goes to the most effective processing of separate treatment phases as well as decrease of energetic rights and costs in the input processing.

For several years is already used the most fine grinding because of there is tendency to increase concentrate quality required by customers and need to treat fine included minerals.

Fine grinding cause higher production of slurries fractions, that during wet treatment get to circulation water what lead to raw material loss and processes of filtration and sedimentation are worse.

One way of the slurries treatment deposited at slurries ponds of Mine František, OKD,a.s. is their re-flotation. The goal of the work was re-flotability review of the slurries with collectors Montanol and Flotakol NX.

Characteristics of used coal slurries

Samples of black coal slurries were used for re-flotation and flotoflocculation. The samples were expressed by letters A, B, C, D, E. Mixed sample was used for mineralogical petrographical analysis. The mixed sample was homogenised from separate sampling points. The petrographical results shows that coal contain 77.6% of vitrinite, 4.4% of liptinite and 18% of inertinite. From the view of microlitotype black coal classification there is dominant vitrite in the sample as well as clarite is often represented and passes to duroclarite in some grains. Iron sulphide was found in well-known forms, the isolated grains with fragment shape and massive character can be determined most often. Euhedrite sulphide was found in small amount at the form of diminutive grains. The occurrence of framboids are unique in coal grains. From mineralogical view the clay minerals are represented in carbargilite grains as well as silver colour grains exhibiting red-orange reflexes.

Sample granularity

Grain size analysis and ash content distribution in separate grain-size was done by wet process on the sieves with mesh size 0.02, 0.063, 0.125, 0.5, 1 mm. From the results of granularity follows (given in table 1-5) that ash is accumulated to the lowest grain size class (below 0.02 mm) where the highest yields and ash content values are reached.

Re-flotation of black coal slurries

The influence of collector dosage as well as collectors selectivity were tested for results of re-flotation. As the collectors were used Montanol (produced in Belgium, its price is 5 times higher as Czech one) and Flotakol NX (produced at Czech republic). The goal of the re-flotation was achieving flotation concentrate quality with ash content below 10%. Basic re-flotation tests were performed with sample A (with collector dosage from 200-700g/t). The re-flotation tests were realised at laboratory of Department of Mineral Processing, VŠB-TU Ostrava under following condition:

- thickening: 150g/l,
- agitation with collector: 1 minute,
- flotation time: 5 minutes.

Results of flotation experiments (with collector Montanol) are given in table 6 and table 7 (collector Flotakol NX was used).

From the results follows that more selective for sample is collector Flotakol NX, with dosage 600g/t was mass yield 56.6% and quality 12.71%. With collector Montanol higher mass yields were achieved but quality of flotation concentrates was worse, as optimum dosage for Montanol becomes evident dose 500g/t. Considering that required concentrate quality with ash content below 10% was not achieved by main flotation even any case, other experiments followed. Re-flotation with one cleaner flotation and one main flotation were realised. There was added any collector to cleaner flotation. These experiments were realised with all samples (A,B,C,D,E) and both collectors with their optimum dosage. The table 9 gives results only with collector Flotakol NX, because with collector Montanol required quality was not achieved even with cleaner flotation. From the results given in table 8 follows that with one main and one cleaner flotation required quality of flotation concentrate was reached with all samples. The best re-flotation tests were attained with samples D, E where the highest mass yields were get.

Flotoflocculation of black coal slurries

The attention was paid to the influence of organic flocculants to re-flotation of black coal slurries. As organic flocculants were used. Magnaflok 1597, Filtraflok 25AP, Magnaflok 156. All flocculants were prepared in 0.1% solution and these doses were tested: 0.1ml, 0.25ml, 0.5ml. Flotoflocculation test was realised with sample B with following procedure: flocculant with selected dose was added and 1 minute agitation proceeded, further collector with dose 600g/t was added and 1 minute agitation continued. The main flotation with 5 minutes and cleaner flotation with 3 minutes followed. The results of flotoflocculation tests are in table 9. Results with flocculant Magnaflok 1597 shows that mass yields increases only with dose 0.1ml, but content of ash rise. With dose enlargement can be seen drop of mass yields, the content of ash remains same as at dose 0.1ml.The concentrate mass yields were drop in all samples with collector Filtraflok 25 AP and the best result is shown at dose 0.5ml/l, when mass yield 32.15% and ash content 8.14% were achieved. This mentioned result is worse as when cleaner flotation is applied without additive flocculant. With Magnaflok 156 the results were deteriorated at all cases because quality of concentrate got over 10%, though concentrate yield decreased with rising dose. It can be seen from the application of organic flocculants that for this type of raw material is their application inconvenient, because worse re-flotation results are achieved.

Conclusion

The goal of the work was appreciation of re-flotability of black coal slurries from slurry ponds of Mine František, OKD, a.s. From obtained results follows, that there is still high amount of coal mass in slurries. The quality of flotation concentrate below 10% of ash can be reached from them by application of one main and cleaner flotation. Influence of organic flocculants were tested for results of re-flotation and obtained results show that their application is not suitable because of increasing of ash values and drop of mass yields concentrate with increasing dose was find out.

Table 1

Screen analysis of sample A

Particle size (mm)	Mass yield (%)	Ash content (%)
-0,02	42,06	41,96
0,02-0,063	25,15	24,06
0,063-0,1	5,43	20,7
0,1-0,5	21,73	15,44
0,5-1,0	5,63	7,24
Sum	100	28,59

Table 2

Screen analysis of sample B

Particle size (mm)	Mass yields (%)	Ash content (%)
-0,02	40,28	41,08
0,02-0,063	45,69	20,45
0,063-0,1	8,42	5,01
0,1-0,5	5,61	3,94
0,5-1,0	0	0
sum	100	26,53

Table 3

Screen analysis of sample C

Particle size (mm)	Mass yields (%)	Ash content (%)
-0,02	29,09	46,09
0,02-0,063	56,37	29,01
0,063-0,1	7,27	6,26
0,1-0,5	7,27	3,51
0,5-1,0	0	0
Sum	100	30,6

Table 4

Screen analysis of sample D

Particle size (mm)	Mass yields (%)	Ash content (%)
-0,02	47,61	42,59
0,02-0,063	11,62	42,38
0,063-0,1	12,47	19,78
0,1-0,5	23,49	6,1
0,5-1,0	4,81	3,89
Sum	100	29,27

Table 5

Screen analysis of sample E

Particle size (mm)	Mass yields (%)	Ash content (%)
-0,02	74,16	36,76
0,02-0,063	16,25	20,02
0,063-0,1	8,75	4,66
0,1-0,5	0,83	5,82
0,5-1,0	0	0
Sum	100	30,97

Table 6

Dose collector influence - sample A
Collector: Montanol, thickening: 150 g/l,
agitation: 1 min, flotation: 5 min

Collector dose (g/t)		Mass yields (%)	Ash content (%)
200	**K**	62,15	26,48
	O	37,85	34,68
	P	100	29,58
300	**K**	73,6	27,55
	O	26,4	37,29
	P	100	30,12
400	**K**	87,06	23,25
	O	12,94	80,34
	P	100	30,64
500	**K**	88,02	18,88
	O	11,98	78,5
	P	100	26,02
600	**K**	87,73	21,64
	O	12,27	82,56
	P	100	29,11
700	**K**	87,32	19,93
	O	12,68	86,63
	P	100	28,39

K - flotation concentrate
O - flotation waste
p - input

Table 7

Collector dose influence - sample A
Collector: Flotakol NX, thickening:
150 g/l, agitation: 1 min, flotation: 5 min

Dose collector (g/t)		Mass yields (%)	Ash content (%)
200	**K**	12,75	16,65
	O	87,25	30,73
	P	100	28,93
300	**K**	21,39	17,77
	O	78,61	33,74
	P	100	30,32
400	**K**	27,29	15,41
	O	72,71	35,27
	P	100	29,85
500	**K**	40,13	12,63
	O	59,87	40,01
	P	100	29,02
600	**K**	56,6	12,71
	O	43,4	52,75
	P	100	30,08
700	**K**	62,67	14,47
	O	37,33	57,66
	P	100	30,59

Table 8

Cleaner flotation
Collector dose: 600 g/t, collector: Flotakol NX, thickening:
150 g/l, agitation: 1 min, main flotation: 5 min,
cleaner flotation: 3 min

Sample		Mass yields (%)	Ash content (%)
A	**K**	21,94	9,95
	Oz	47,17	41,04
	Op	30,89	29,57
	P	100	30,9
B	**K**	34,62	6,33
	Oz	48,04	41,73
	Op	17,34	31,35
	P	100	27,88
C	**K**	32,72	8,34
	Oz	45,91	48,54
	Op	21,37	27,84
	P	100	30,99

cont. table 8

D	**K**	38,81	8,99
	Oz	35,73	46,4
	Op	25,46	38,11
	P	100	29,77
E	**K**	46,27	8,23
	Oz	37,56	55,13
	Op	16,17	37,92
	P	100	30,64

Table 9

Influence of organic flocculants dose on results of re-flotation - sample B - cleaner flotation

Flocculants dose		Mass yields (%)	Ash content (%)
Magnaflok 1597			
0,1 ml	**K**	42,01	9,55
	O_1	29,27	56,2
	O_2	28,72	25,67
	P	100,00	27,83
0,25 ml	**K**	33,00	9,27
	O_1	35,55	47,68
	O_2	31,45	25,91
	P	100,00	28,16
0,5ml	**K**	29,16	9,7
	O_1	41,95	44,95
	O_2	28,89	21,28
	P	100,00	27,83
Filtraflok 25 AP			
	K	15,73	13,41
0,1 ml	**O1**	58,23	35,64
	O2	26,04	24,44
	P	100,00	29,23
	K	29,36	8,05
0,25 ml	**O1**	41,14	45,43
	O2	29,5	23,52
	P	100,00	27,99
	K	32,15	8,14
0,5 ml	**O1**	39,37	46,88
	O2	28,48	23,65
	P	100,00	27,81
Magnaflok 156			
	K	40,51	10,02
0,1 ml	**O1**	29,68	53,86

cont. table 9

	O2	29,81	25,58
	P	100,00	27,67
	K	32,9	10,44
0,25 ml	O1	36,58	45,14
	O2	30,52	26,58
	P	100,00	28,06
	K	26,1	10,51
0,5 ml	O1	42,73	42,42
	O2	31,17	22,07
	P	100,00	27,75

K - flotation concentrate
O_1 - waste from flotoflocculation
O_2 - waste from cleaner flotation
P - input

REFERENCES

1. Fečko P., Zelingerová I., Augustínská I.: Application of yeast in coal flotoflocculation. Memorias II.International congreso de ciencia y technologia del carbon, Paipa (Boyacá), Colombia, 19.-22.5.1998, pp.134-138.
2. Fečko P., Zelingerová I., Drobík M.: Reflotace uhelných kalů z odkališť Dolu Lazy, Zborník Recyklace odpadů,VŠB-TU Ostrava,1997,s.178-185.

Streszczenie

Badane próbki mułów węglowych użyte do flotacji i flotoflokulacji oznaczono literami A,B,C,D i E. Dla uśrednionej próbki wykonano analizy petrograficzne, które wykazały następujący skład maceralny węgla: 77,6% witrynitu, 4,4% egzynitu i 18% inertynitu. Z mikrolitotypów dominujący był witryt, często także występował klaryt przechodzący w duroklaryt w niektórych ziarnach. Minerały ilaste były w postaci karbargilitu. Wszystkie badane próbki mułów węglowych o zawartości popiołu około 30% posiadały najwięcej

najdrobniejszej klasy o uziarnieniu poniżej 0,02 mm i ta klasa ziarnowa była równocześnie najbardziej zapopielona. Zawartość popiołu w tej klasie wynosiła w większości przypadków ponad 40% (tab. 1-5).

Do flotacji zastosowano jako zbieracze Montanol produkcji belgijskiej i Flotakol NX produkcji czeskiej. Okazało się, że Flotakol NX działa bardziej selektywnie w stosunku do Montanolu. Dla Montanolu otrzymano wyższe wychody, lecz jakość koncentratów była gorsza. Optymalne dawki dla zbieraczy były: dla Flotakolu 600 g/t, a dla Montanolu 500 g/t. Ponieważ nie uzyskano koncentratów o żądanej zawartości popiołu poniżej 10%, zastosowano flotacje czyszczące dla wszystkich badanych próbek przy optymalnych dawkach zbieraczy. Dla Montanolu nie uzyskano zadowalających wyników, a dla Flotakolu uzyskano koncentraty o zawartości popiołu poniżej 10% już po pierwszej flotacji czyszczącej (tab.8). Zbadano także wpływ na wyniki flotacji flokulantów organicznych takich, jak: Magnaflok 1597, Filtraflok 25AP, Magnaflok 156. Wyniki flotoflokulacji podaje tabela 9. Z danych tych widać, że zastosowanie tych flokulantów nie ma korzystnego wpływu na wyniki flotacji mułu, gdyż zaobserwowano wzrost zawartości popiołu w koncentracie przy równoczesnym spadku jego wychodu. A zatem aby otrzymać koncentraty węglowe o zawartości popiołu poniżej 10% z mułu pochodzącego ze stawu osadowego, należy wykonać flotację główną z jednym czyszczeniem stosując jako zbieracz Flotakol NX.