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FUEL RESEARCH INSTITUTE

OF SOUTH AFRICA

TEGNIESE MEMORANDUM
TECHNICAL

NO. 4 OF 1974

REPORT ON BENEFICIATION OF LANDAU 3 MINUS 0,5 mm FINES

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1. INTRODUCTION

The success achieved in producing a low ash content coal in single-stage separation at high feed rates (see Technical Memoranda Nos. 15 and 31 of 1973), motivated the subsequent extension of investigations to include a bulk sample of Landau minus 0,5 mm fines, obtained by selective mining.

The programme commenced with single-stage separation on the Deister Table, and as many variations as possible were investigated intensively to obtain a product of low ash content at different feed rates. Results indicated that at a maximum load of 0,75 t/h, corresponding to a load equivalent to 3,0 t/h for a production size table, ash values could only be reduced to ± 7,0 per cent in the + 75 micron fraction. Consequently the following alternative processing procedures were investigated.

1. Treatment by Froth Flotation.
2. Treatment by Compound Water Cyclone; single- and double-stage separation.
3. Combination:
   - (a) Treatment by Deister Table followed by Froth Flotation.
   - (b) Treatment by Froth Flotation, followed by Deister Table.
   - (c) Treatment by Deister Table followed by Cyclone Classifier.
   - (d) Treatment by Compound Water Cyclone, followed by Tabling.
   - (e) Treatment by Deister Table followed by Compound Water Cyclone.

/The .....

2. THE COAL

The coal used in all investigations was a minus 0,5 mm fraction of a bulk sample, selectively mined only from the bottom part of the Witbank No. 2 seam. Termed "Airovibe Overflow", it was obtained as a screen product from the Landau preparation plant.

The results of sieve ash analyses, reproduced in Table 1, indicate a size distribution analogous to that of bulk samples investigated previously.

Although the minus 75 micron fraction of the coal sample, as received, had been reduced by means of Cyclone Classifiers to approximately 8,0 mass per cent, the residual minus 75 micron fraction in the sample investigated contained a very high ash content, viz. 30,4 per cent. The washability characteristics are shown as M-curve 1.

It is remarkable that the slimes, henceforth termed "Thickener Underflow" and made available in bulk to the F.R.I. as a thickened product from the Cyclone Classifiers, have an ash content of only 13,2 per cent. A subsequent size grading indicated that 51,4 mass per cent of the material is smaller than 20 micron and consequently not suited to tabling or cyclone preparation, but can be treated successfully by froth flotation.

3. TREATMENT OF THE COAL

3.1. Treatment by Deister Table

3.1.1. Wet feeding

All tabling tests were carried out as a batch operation in open circuit to comply with previous investigations described in Technical Memoranda Nos. 3/73 and 31/73, Section 2.1. The solids content in the feed pulp, which is directly proportional to the feed rate to the table, was varied from 225 g/l (i.e. 20,9 mass per cent) to 562 g/l (i.e. 47,3 mass per cent) to obtain loadings ranging from 0,5 t/h to 1,25 t/h (equivalent to a

/2,0 t/h .....

2,0 t/h to 5,0 t/h range for a production size table.) Certain deviations from calculated values observed in the reconstituted values could be due to uneven distribution of the moisture in the bulk sample of the coal as received.

3.1.2. Dry-feeding system

With wet feeding it was noticed that the ash content of the feed pulp, which corresponded within limits with the cumulative ash contents of the total table discharge sampled, fluctuated from 15,0 to 17,1 per cent, and it was assumed that this was due to a slight separating effect taking place in the feed bin.

To eliminate these suspected effects, several tests were conducted using a dry-feeding system made available by the Iscor Pilot Plant. In essence, both the dry solids and the water streams are metered independently and prior to mixing. In this fashion a homogenous pulp, at a pre-selected solids concentration, can be obtained at the desired feed rate.

It was observed, however, that even with this system the variations in the ash contents still persisted and this feed system was therefore discarded in favour of the less cumbersome wet-feed system.

3.1.3. Operating variables

The mechanical settings of the Deister Table were as follows:

Speed of motion	305 r.p.m.
Length of stroke	13 mm
End elevation	12,5 mm
Side tilt	1,5 to 2,0^{o}

/Tests .....

Tests commenced at a feed rate of 0,5 t/h, which was increased to 1,25 t/h in steps of 0,25 t/h. Various water distributions were implemented (see Table 2 for a typical distribution) and the results obtained are tabulated in Table 3.

The increased feed rates resulted in a deterioration of the separating effect, as demonstrated graphically in M-curve 2. Variations in feed-solids concentration and additional wash water could not effect a 7,0 per cent ash product at feed rates in excess of 0,5 t/h.

It was further noticed that at total water supplies in excess of 80 l/min, diagonal currents developed across the table surface, which had a detrimental effect on the stratification. A high total water/solids ratio, however, was required for an effective separation, and therefore, the end elevation was reduced to 6 mm. By flattening the table surface, a more even distribution of the coal-bed was achieved, and a low ash content product could be obtained on increasing the feed rate to 0,8 t/h. The results of these tests are reported in Table 4.

3.2. Treatment by Froth Flotation

Tests with pulps of approximately 12,0 per cent solids were conducted on the slurry and slime described in Section 2. The object was to find a suitable reagent that would effectively froth flotate the coal. Eighteen laboratory tests on the "Airovibe Overflow" were conducted in a Denver No. 8 single cell, using reagents such as turpentine, eucalyptus oil, pine oil, paraffin (ordinary lighting paraffin), M.I.B.C., dieselene and kerosene (power paraffin). These reagents were administered separately or in combinations and at various aeration rates. The effects of these parameters are summarized in Table 5.

/Four .....

Four additional tests were performed, using the Thickener Underflow product. From the results, also reported in Table 5, it can be seen that this very fine material floats extremely well, and comparatively low ash contents, of the order of 7,4 per cent at yields in excess of 50,0 per cent, can be obtained. The froth products, however, had no swelling properties. From the foregoing results it was concluded that combinations of turpentine and eucalyptus oil or pure kerosene are the most suitable reagents for this coal. The latter has the advantage of a low price and availability, which makes it even more attractive.

3.3. Treatment by Compound Water Cyclone

3.3.1. Single-stage separation

The suitability of the Compound Water Cydone for cleaning Landau fines was investigated by means of an abridged factorial test. The cyclone settings were chosen so that the range of yields covered the region of interest, i.e. 50 - 85%.

The influence of three operating variables was studied: those of vortex finder diameter, vortex finder clearance, and apex diameter. The solids percentage in the feed was in all tests fixed at 10% and the inlet pressure at 0,7 kg/cm^2. All tests were conducted in batch operation in closed circuit, which, together with the method of sampling, is described in Technical Memorandum No. 15 of 1973.

The ash reduction in the tests with yields up to 60% (narrow vortex finder) was about 6 - 7%, and in the tests with higher yields (wide vortex finder) it was 4 - 6%. The feed rates were 2,2 - 2,3 tons of dry coal per hour. A further ash reduction of some 2% was achieved by removal of the minus 75 micron fraction from the product, which, however, reduced the actual yield by 8 - 12% (absolute).

/The .....

The conclusion which can be drawn from these tests is that a Compound Water Cyclone operating in single stage cannot produce low-ash coal from Landau fines. With acceptable yields, it can clean this coal to 11,0 - 11,5% ash in the total product or to 9,0 - 9,5% in the deslimed product.

3.3.2. Two-stage operation

The first stage was a bulk washing under optimum settings obtained from the factorial test and producing a yield of about 75%. These settings were: wide vortex finder (100 mm), long vortex finder clearance (130 mm) and wide apex valve diameter (50 mm).

With these settings, the coal was cleaned from 17,6% ash in the feed to 11,5% at a yield of 74,8%. The plus 75 micron product, amounting to 64,0% of the total feed, contained 9,6% ash (see Table No. 6, Test No. 1).

This coal was then rewashed at four different cyclone settings (Table No. 6, Tests Nos. 16 - 19). The feed pressure was reduced from 0,7 to 0,56 kg/cm^2 because of the lower density of the feed. This resulted in slightly lower feed rates than those of the factorial tests.

All tests showed very poor separation, the ash reduction being only 1 - 2%. Screening off the minus 75 micron fines from the product again yielded some 2% additional ash reduction. Ultimately, a plus 75 micron product with an ash content of 8,0 - 8,5% was produced at yields of 33 - 45% (of second-stage total feed), which means 25 - 34% over both stages. For example, the mass and ash balance of Test No.2 are the following:

/2nd stage .....

	% yield	% ash	% yield	% ash
2nd stage product (+75 micron)	24,7	@ 8,1	33,0	@ 8,1
2nd stage product (-75 micron)	9,9	@ 16,1	13,3	@ 16,1
2nd stage discard	40,2	@ 13,4	53,7	@ 13,4
2nd stage feed (1st stage product)	74,8	@ 12,0*(11,5)	100,0	@ 12,0*(11,5)
1st stage discard	25,2	@ 35,8		
1st feed (original)	100,0	@ 18,0*(17,6)		

* Discrepancy due to sedimentation in the feeding tank.

As can be seen from the above, the first-stage product, containing 11,5% ash, appears as 12,0% ash second-stage feed. This difference certainly affects the final product. This would be avoided if a continuous operation of two cyclones were employed. Perhaps a more sophisticated compact two-stage system with recirculation of the middlings would be more adequate.

3.4. Combination of 3.1., 3.2. and 3.3.

3.4.1. Treatment by Deister Table followed by Froth Flotation

The product representing a yield of 73,1 per cent with an ash content of 9,4 per cent and a Swelling Number of 3, produced at a feed rate of 1,32 t/h to the Deister Table, was re-treated by froth flotation. The most effective reagents determined by previous tests were used, and as shown in Table 5, yields of 78,2 and 62,2 per cent with ash contents of 7,8 and 7,7 per cent, respectively, were obtained.

The overall yield of the final product would thus be 57,2 per cent with an improvement in ash of 1,6 per cent, and 45,5 per cent with an ash improvement of 1,7 per cent.

/3.4.2. .....

3.4.2. Treatment by Froth Flotation followed by Tabling

A 2,0 t portion of the bulk sample was treated by froth flotation in the Fagergren Froth Flotation cells at the F.R.I. Pilot Plant. The test was conducted on a semi-commercial basis, and the solids were hand-fed into the conditioner preceding the cells. The solids concentration in the feed pulp was estimated to range from 10 to 15 per cent, and kerosene (power paraffin) at a rate of 350 g per ton of dry solids feed was used as the sole reagent. In addition to the advantages of kerosene, listed in Section 3.2., the possibility of damaging the Deister Table's rubber-lined deck with oily reagents would be avoided.

The results obtained were as follows:

Yield (weight balance)		58,1 per cent
(ash balance)		59,8 per cent
	mean value	59,0 per cent

Ash contents

Feed	15,9 per cent
Product	10,8 per cent
Tailings	23,5 per cent

Swelling Number of product 3

The product was rewashed on the Deister Table at feed rates of 1,0 and 1,29 t/h, respectively. The results are reported in Table 4.

A final product with an ash content of less than 7,0 per cent could not be obtained at all. Based on a single-stage test by means of which a product with a total ash

/content .....

content of 8,3 per cent could be obtained at a total yield of 54,4 per cent, 7,5 per cent ash content and 49,6 per cent yield in the plus 75 micron fraction, the overall yield at 8,2 per cent ash content of this combination would be 44,5 and 44,2 per cent, at feed rates of 1,0 and 1,29 t/h, respectively.

3.4.3. Treatment by Deister Table followed by Cyclone Classifier

A product representing a yield of 74,4 per cent with a total ash content of 8,1 per cent, produced at a feed rate of 0,5 t/h, was air dried for desliming tests with a 6" Cyclone Classifier (DorrClone) to compare results obtained in practice with wet-sieve analyses. The complete removal of the minus 75 micron fraction from a product representing a yield of 62,4 per cent with an ash content of 7,6 per cent, i.e. at an overall yield of 58,0 per cent, can result in a product having an ash content of 6,9 per cent.

The removal of the minus 75 micron fraction with a Cydone Classifier produced the following optimum results:

Cyclone underflow:	yield	93,3 per cent
	ash content	7,8 per cent
Cyclone overflow:	yield	6,7 per cent
	ash content	13,8 per cent

The overall yield of the final product would thus be 69,4 per cent, with an additional ash reduction of 0,4 per cent.

/3.4.4. .....

3.4.4. Treatment by Compound Water Cyclone followed by Tabling

The products, i.e. cyclone overflow, from the Compound Water Cyclone test reported in Table 6, Tests 9 and 10, were rewashed on the Deister Table. The results are reported in Table 4.

3.4.5. Treatment by Deister Table followed by Compound Water Cyclone

In the first stage the coal was washed on the Deister Table, giving a yield of 69,7%. The ash content of the product was 9,9% or, after screening off the minus 75 micron fraction, 89% at a yield of 63,2% (absolute).

The total product was then cycloned at several different settings. The results are reported in Table No. 6, Tests Nos. 6 - 8.

There again the separation was very poor and the ash reduction was only about 1,5%. The ash in the plus 75 micron fraction was 0,5 - 1,0% lower than the total product.

The cyclone-feed ash was slightly higher than the Table product, again due to insufficient turbulance in the feeding tank. In spite of this minor drawback the cyclone has produced a plus 75 micron clean coal with about 8% ash at the yields of 42 - 59% or at overall yields of 29 - 41%. It appears that the Compound Water Cyclone is, in the case of Landau fines, unsuitable for the recleaning of Deister Table products.

/5. .....

5. EFFICIENCY OF DEISTER TABLE

The successful production of a low ash content product, i.e. 7,1 per cent ash in the plus 75 micron fraction at a feed rate of 0,8 t/h by single-stage operation, warranted additional investigations. These were limited to the 1 x 0,075 mm size fraction, since for this size range float-and-sink analysis can readily be conducted without the introduction of serious errors.

The fraction of minus 75 micron material in the products is roughly the same as that in the feed, and it therefore follows that no serious error will result if this material is neglected when evaluating the yield.

The results were evaluated and the following parameters were obtained:

Correlation coefficient	0,88
Cut point	1,45 r.d.
Probable error	0,0812

The misplaced material at the cut point was 13,8 per cent and 14,2 per cent for the floats and sinks, respectively.

The organic efficiency at 7,1 per cent ash content is:

$$\eta = \frac{54,8}{74,5} \times 100$$

$$= \underline{\underline{73,7 \text{ per cent}}}$$

6. CONCLUSIONS

6.1. Deister Table

In single-stage operation a clean coal with an ash content of 7,0 per cent in the size range 1 x 0 mm could only be produced at a very low load of 0,5 t/h and a low yield.

/At .....

At higher feed rates the separating effect deteriorated progressively, and no low-ash products could be obtained.

Two-stage operation allowed higher feed rates, but the required ash reduction to 7,0 per cent could only be achieved in the plus 75 micron fraction. The economical removal of the slimes, i.e. minus 75 micron, with up to 30,0 per cent ash, is a necessity for low-ash coal production on Concentrating Tables.

6.2. Froth Flotation

Products could be obtained with ash contents ranging from 7,5 to 11,1 per cent, but the net result (i.e. ash content and corresponding yield) is determined by the reagents employed. If it is kept in mind that froth flotation products include the troublesome minus 75 micron fraction, an economical advantage over Tables cannot be denied.

6.3. Compound Water Cyclone

The single-stage operation resulted in a product with 11,0 - 11,5% ash at yields of 55 - 75%. After complete removal of the minus 75 micron fraction, the yield was reduced to 47 - 64% and the ash content to 9,0 - 9,5%. Washing at lower yields did not improve the product.

Rewashing of this coal in the second stage reduced the ash to 10,0 - 10,5% or to 8,0 - 8,5% in the plus 75 micron fraction. However, the yields were rather low. The overall yields of the plus 75 micron product vary between 25 and 34%.

Recleaning of the Deister Table product again proved to be inefficient. A plus 75 micron product, containing about 8% ash, was produced at the overall yield of 29 - 41%.

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It can be concluded that the Compound Water Cyclone is efficient and economical for "scalping" the coal in the first stage, but is unsuitable for "polishing" in the second stage.

6.4. Combinations

Rewashing of products in different sequences resulted in a low-ash coal only when the Deister Table was used in the second stage, and when the minus 75 micron fraction was removed from the final product.

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TABLE 1

SIZE ASH ANALYSES OF LANDAU FINES

(a) AIROVIBE OVERFLOW

Size Microns	Fractional		Cumulative	
	Mass %	Ash %	Mass %	Ash %
+ 1000	4,4	15,0	4,4	15,0
1000 x 500	26,9	15,0	31,3	15,0
500 x 250	31,3	15,8	62,6	15,3
250 x 125	20,6	15,7	83,2	15,4
125 x 75	8,5	19,7	91,7	15,8
- 75	8,3	30,4	-	-
Total	100,0	-	100,0	17,1

(b) THICKENER UNDERFLOW

Size Microns	Mass %	Cum. Mass %
+ 500	1,6	1,6
500 x 250	2,0	3,6
250 x 125	6,0	9,6
125 x 63	16,0	25,6
63 x 32	16,4	42,0
32 x 25	3,2	45,2
25 x 20	3,4	48,6
- 20	51,4	-
Total	100,0	100,0

Percentages evaluated from Alpine air-jet sieve analysis.

Total ash content: 13,2%

/TABLE 2 .....

TABLE 2

TEST: 49/73/1d (Bulk sampled) 0,61 t/h, 24,4% SOLIDS

SOLIDS AND WATER DISTRIBUTION OF DEISTER TABLE

Feed										Clean Coal				Discard			
Pulp to Table					Dress Water	Pulp on Table				Pulp		Yield	Ash	Pulp		Yield	Ash
Solids (AD)			Water			Solids (AD)		Water		Solids	Water			Solids	Water		
t/h	kg/min	Mass %	l/min	Mass %	l/min	kg/min	Mass %	l/min	Mass %	Mass %	Mass %	%	%	Mass %	Mass %	%	%
0,6	10,1	24,4	31,4	75,6	30,4	10,1	14,0	61,8	86,0	15,5	84,5	74,4	8,1	11,1	88,9	25,6	34,8

Remarks: The air-dried clean-coal product (total of 212,5 kg) was further tested with a DorrClone for thickening and desliming.

/TABLE 3 .....

TABLE 3

SUMMARY OF DEISTER TABLE PERFORMANCE TESTS WITH LANDAU FINES

Test No.		49/73/1				49/73/2			49/73/3			49/73/4
		a	b	c	d	a	b	c	a	b	c	a
Solids feed rate	t/h	0,5	0,5	0,5	0,5	0,75	0,75	0,75	1,0	1,0	1,0	1,25
(Calculated)	kg/min	8,3	8,3	8,3	8,3	12,5	12,5	12,5	16,7	16,7	16,7	20,8
Solids feed rate	t/h	0,5	0,51	0,49	0,61	0,72	0,71	0,73	0,88	0,92	0,97	1,32
(Measured)	kg/min	8,4	8,4	8,14	10,1	12,05	11,8	12,1	14,6	15,4	16,2	22,0
Feed solids at feed bin	g/l	225	225	Dry feed	225	338	338	Dry feed	450	450	Dry feed	562
(Calculated)	mass %	20,9	20,9	-	20,9	30,4	30,4	-	39,2	39,2	-	47,3
Feed solids at feed box	g/l	225	230	220	266	326	319	218	296	311	258	241
(Measured)	mass %	20,9	21,4	20,5	24,4	29,4	28,8	20,4	26,9	28,2	23,8	22,4
Feed water from bin	l/min	31,5	31,5	31,5	30,3	29,0	29,1	47,3	27,3	26,7	52,0	22,3
	%	51,2	44,1	51,2	49,1	49,2	42,1	61,2	39,2	33,8	63,4	18,9
Dilution water to feed box	l/min	NIL	NIL	NIL	NIL	NIL	NIL	NIL	12,4	12,4	NIL	54,0
	%								17,8	15,7		45,6
Dress water	l/min	30,0	40,0	30,0	30,4	30,0	40,0	30,0	30,0	40,0	30,0	42,0
	%	48,8	55,9	48,8	50,1	50,8	57,9	38,8	43,0	50,5	36,6	35,5
Total water feed rate to table	l/min	61,5	71,5	61,5	60,7	59,0	69,1	77,3	69,7	79,1	82,0	118,3
Total water/solids	mass ratio	7,4:1	8,6:1	7,4:1	6,0:1	4,9:1	5,9:1	6,4:1	4,7:1	5,1:1	5,1:1	5,4:1
Yields, per cent												
Clean coal	total	67,8	67,6	60,4	74,4	40,3	54,2	55,5	45,4	62,0	60,1	73,1
	+75 micron	63,6	63,0	ND	ND	36,1	49,9	ND	40,8	56,7	ND	ND
Discard	total	32,2	32,4	39,6	25,6	59,7	45,8	44,5	54,6	38,0	39,9	26,9
Ash contents, per cent												
Feed												
Actually found in feed bulk sample		15,3	15,0	14,4	15,2	17,1	15,6	17,0	16,7	16,1	16,2	15,1
Cumulative		15,1	15,5	15,4	15,0	16,7	15,9	16,9	17,5	15,6	16,4	15,1
Clean coal												
Cumulative	total	7,5	7,8	7,8	8,1	8,3	8,1	8,2	9,5	9,3	8,2	9,4
Cumulative	+75 micron	7,1	7,2	ND	ND	7,1	7,3	ND	8,1	8,4	ND	ND
Discard												
Cumulative	total	31,3	31,6	27,2	34,8	22,3	25,0	27,5	24,2	25,9	28,6	30,6
Remarks and Swelling No.:		3½	4	4	Bulk sampled for Cyclone de-sliming tests	3½	4-	3½	3	3	3½	Composite sample for Froth Flotation tests

/TABLE 4 .....

TABLE 4

SUMMARY OF DEISTER TABLE PERFORMANCE TESTS WITH LANDAU FINES

Test No.		49/73	49/73	49/73/3		49/73	49/73	49/73
		1e	2d	d	e	4b	3f	3g
Solids feed rate (Calculated)	t/h	0,5	0,75	1,0	1,0	1,25	1,0	1,0
	kg/min	8,3	12,5	16,7	16,7	20,8	16,7	16,7
Solids feed rate (Measured)	t/h	0,51	0,80	1,10	0,98	1,29	0,90	0,98
	kg/min	8,6	13,4	18,4	16,4	21,6	14,9	16,3
Feed solids at feed bin (Calculated)	g/l	225	338	450	450	562	450	450
	mass %	20,9	30,4	39,2	39,2	47,3	39,2	39,2
Feed solids at feed box (Measured)	g/l	232	244	364	332	350	302	330
	mass %	21,5	22,4	32,5	29,9	31,3	27,4	29,7
Feed water from bin	l/min	31,3	28,1	24,7	26,1	22,6	27,1	26,1
	%	51,1	36,7	36,2	38,1	29,2	39,0	38,1
Dilution water to feed box	l/min	NIL	18,4	13,5	12,4	24,6	12,4	12,4
	%		24,1	19,8	18,1	31,9	17,8	18,1
Dress water	l/min	30,0	30,0	30,0	30,0	30,0	30,0	30,0
	%	48,9	39,2	44,0	43,8	38,9	43,2	43,8
Total water feed rate to table	l/min	61,3	76,5	68,2	68,5	77,2	69,5	68,5
Total water/solids	mass ratio	7,1:1	5,7:1	3,7:1	4,2:1	3,6:1	4,7:1	4,2:1
Yields, per cent								
Clean coal	total	58,7	54,8	54,4	75,4	74,9	74,5	64,5
	+75 micron	54,6	48,8	49,6	ND	ND	67,4	55,1
Discard	total	41,3	45,2	45,6	24,6	25,1	25,5	35,5
Ash contents, per cent								
Feed								
Actually found in feed bulk sample		16,4	16,9	17,2	11,0	10,6	12,0	12,2
Cumulative		16,7	16,6	16,9	10,7	10,5	11,3	12,0
Clean coal								
Cumulative	total	7,6	8,1	8,3	8,2	8,2	8,0	8,3
Cumulative	+75 micron	6,7	7,1	7,5	ND	ND	7,0	7,0
Discard								
Cumulative	total	29,6	26,8	27,2	18,4	17,1	21,1	18,7
Remarks and Swelling No.:		4-	3½	3	Rewashing of flotation product 3½	3½	Rewashing of C.W.C. product 4-	3

/TABLE 5 .....

TABLE 5

FROTH FLOTATION RESULTS ON LANDAU, SAMPLE NO. 48/73

RAW COAL ASH 17,5% SWELLING NO. 1+

Test No.	Remarks	Reagent Dosages		Product % Yield	Product % Ash	Product S.W. No.
1	Reagents administered together	5 ml Turpentine	5 ml Eucalyptus	87,6	12,5	
2	Reagents administered together	5 ml Turpentine	5 ml Pine Oil	88,7	13,0	
3	Combined product of tests 1 and 2	2 ml Turpentine	2 ml Eucalyptus	96,6	12,1	3-
4	Reagents administered together	1 ml Turpentine	2 ml Eucalyptus	85,1	12,2	
5	Reagents administered together	2 ml Turpentine	1 ml Eucalyptus	86,1	12,3	
6	Reagents administered together	1 ml Paraffin	2 ml M.I.B.C.	25,1	8,4	2½+
7	Reagents administered together	1 ml Turpentine	1 ml Eucalyptus	84,7	12,1	3½-
8	Reagents administered together	½ ml Turpentine	½ ml Eucalyptus	79,0	11,1	3½+
9	Reagents administered together	¼ ml Turpentine	¼ ml Eucalyptus	19,9	7,5	4
10	Reagents administered together	½ ml Eucalyptus		65,7	10,6	2½+
11	Reagents administered together	¼ ml Turpentine	½ ml Eucalyptus	46,8	9,6	2½+
12	Reagents administered together	½ ml Turpentine	¼ ml Eucalyptus	28,2	8,0	3½
13	Reagents administered together	½ ml Diesoline	¼ ml Eucalyptus	24,3	8,4	3½
14	Minimum air supply allowed Reagents administered separately	½ ml Turpentine	½ ml Eucalyptus	48,3	9,1	2½+
15	Minimum air supply allowed Reagents administered separately	½ ml Kerosene	½ ml Eucalyptus	68,3	9,9	3½
16	Minimum air supply allowed Reagents administered separately	1 ml Kerosene	5 ml M.I.B.C.	4,4	7,3	4½
17	Minimum air supply allowed Reagents administered separately	1 ml Kerosene	½ ml Eucalyptus	50,5	9,0	3
18	Kerosene appears very promising when administered alone	5 ml Kerosene		61,5	10,2	3-
19	Tested with Thiokener Underflow R.C. Ash 13,7 Reagents administered together	½ ml Turpentine	½ ml Eucalyptus	88,9	8,8	0
20	R.C. Ash 13,7 Reagents administered separately	½ ml Turpentine	½ ml Eucalyptus	86,1	8,2	0
21	R.C. Ash 13,7 Minimum air. Reagents administered together	½ ml Kerosene	¼ ml Eucalyptus	56,0	7,4	0
22	R.C. Ash 13,7 Minimum air	2 ml Kerosene		53,1	7,4	0
23	This coal already washed on Deister Table R.C. Ash 9,0% Swelling No. 3	½ ml Kerosene	½ ml Eucalyptus	78,2	7,8	3½
24	This coal already washed on Deister Table R.C. Ash 9,0% Swelling No. 3	1 ml Eucalyptus		62,2	7,7	4½-
25	Continuous test run at Pilot Plant	Kerosene 0,537 kg/ton		59,8	10,8	3-

/TABLE 6 .....

TABLE 6

COMPOUND WATER CYCLONE PERFORMANCE DATA

Test No.	Description	Settings				Yield single (overall)		% Ash			+75 micron clean coal			Feed rate t/h dry
		VFD mm	VFC mm	AD mm	IP kg/cm^2	%	%	Feed	Clean Coal	Discard	% Yield single (overall)		Ash %	
1	First stage	100	130	50	0,7	74,8		17,6	11,5	35,8	64,0		9,6	3,5
2	Second stage	67	10	40	0,56	46,3	(34,6)	12,0	10,4	13,4	33,0	(24,7)	8,1	2,1
3	Second stage	67	90	30	0,56	48,0	(35,9)	11,9	10,0	13,7	34,0	(25,4)	8,3	2,1
4	Second stage	67	10	30	0,56	61,0	(45,6)	11,6	10,4	13,5	45,6	(34,1)	8,6	2,2
5	Second stage	100	130	50	0,56	87,8	(65,7)	12,0	11,0	19,6	71,9	(53,8)	9,1	3,1
6	Rewash of	67	90	30	0,56	50,0	(34,9)	10,4	8,5	12,3	41,5	(28,9)	7,8	2,0
7	Deister Table	67	10	30	0,56	65,7	(45,8)	10,3	9,0	12,8	54,7	(38,1)	7,9	2,1
8	product	67	10	30	0,7	68,8	(48,0)	10,1	8,8	13,1	59,0	(41,1)	8,2	2,5
9	Prewash for	100	130	50	0,7	73,8		18,0	11,6	36,1	63,4		9,7	3,6
10	Deister Table	100	130	40	0,7	79,1		17,9	12,0	40,4	67,4		9,9	3,7

F.R.I.

COAL PREPARATION

M-CURVE 1

R.D.

R.D. INTERVAL	Wt. %	ASH %	v% a%	M-CURVE Σ v%	Σ v% a%	a%
-1,35	38,9	3,7	143,8	38,9	143,9	3,7
-1,40	14,6	7,4	108,3	50,5	252,1	4,7
-1,45	8,5	10,0	84,9	62,0	337,0	5,4
-1,50	10,2	13,3	135,5	72,2	472,5	6,5
-1,55	6,5	16,3	105,5	78,7	578,0	7,3
-1,60	4,4	21,5	95,7	83,1	673,7	8,1
+1,60	16,9	51,5	870,3	100,0	154,0	15,4

PLANT: DEISTER TABLE

FEED: LANDAU 3, FINES + 75 µm

TEST: 49/73

REPORT: 4/74

REMARKS:

C.C. YIELD 76,2 % AT 7,0 % ASH

DISCARD 23,8 % AT 42,5 % ASH

C.P. : 1,53 r. d.

± 0,1 NEAR GRAVITY MATERIAL : 26,3 %

YIELD IN v%

ASH IN a%

F.R.I.
COAL PREPARATION

M-CURVE 2

ZONE

S.G. INTERVAL	Wt. %	ASH %	v% a%	M-CURVE Σ v%	Σ v% a%	a%

PLANT: DEISTER TABLE

FEED: LANDAU 3 FINES 1 x 0 mm

TEST: 49 / 73 /

REPORT: 4 / 74

REMARKS:

LOAD 0,5 t/h : (1 a)

0,75 t/h : (2 b)

1,0 t/h : (3 b)

1,25 t/h : (4 a)

YIELD IN v%

ASH IN a%