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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

15 p. tables

21934

DMT

Final Report

Feasibility Test of Carbon Black Production from Tar Oil

UNIDO - Project US/IND/93/140
Purchase Order No.: 15-7-1025U

Prepared by: DMT-Gesellschaft für Forschung und Prüfung mbH
DMT-FuelTec
Franz-Fischer-Weg 61
45307 Essen

Responsible: Dr. Manfred Kaiser
Tel.: +49/201/172-1789
Fax: +49/201/172-1023

1 INTRODUCTION

The Neyveli Lignite Corporation Ltd. will investigate the feasibility to use tar oil from the carbonisation of lignite as carbon black feedstock. The Bureau of Mines Correlation Index (BMCI), is a particularly important criterion of the quality of a carbon black feedstock. The investigation of the BMCI and other investigations were done by DMT-FuelTec.

2 BUREAU OF MINES CORRELATION INDEX - BMCI

In the furnace process, which today dominates carbon black production, oils rich in aromatics from naphtha or gas oil pyrolysis, and mixtures of aromatics from coal tar, are used as feedstock. The Bureau of Mines Correlation Index (BMCI) defined below, is a particularly important criterion of the quality of the carbon black feedstock:

$$BMCI = 473.7 * d - 456.8 + 48640 * K^{-1}$$

Here, d is the density of the hydrocarbon mixture in g/ml at 15.6 °C and K the average boiling temperature in Kelvin.

Hydrocarbon mixtures of predominantly nature have a correlation index (CI) from 15 to 50; benzene, according to the defining, has a CI of 100, while high-boiling aromatic mixtures have a correlation index in excess of 100. The yield of carbon black increases as the correlation index rises; the highest yields are obtained using three- and four-ring aromatic compounds /1/.

3 TAR SAMPLE

A one kg tar sample was delivered from Neyvelis Lignite Corporation Ltd., Dy. Chief Scientist, with a covering letter dated 28.02.1997, via Mr. Grant Ramsay, UNIDO officer, Vienna, to DMT. The sample arrived on 10.03.1997.

4 ANALYSIS

Visual judgement

The sample is waxy and seems inhomogeneous, the color is light to dark brown

Density

Determination of density with Areometer (DIN 51757, 1984 and ISO 3675, 1975)
The density was determined at 60 °C and converted to 15.6 °C.

$$\rho\ (15.6\ °C) = \rho_E\ (t) + \alpha\ (t - 15.6\ °C)$$

Here, ρ is the density, ρ_E the density at measuring temperatur t and α a temperature coefficient ($\alpha = 0.63\ kg/cm^3 * K$)

ρ_E (60 °C) = 929 kg/m³
ρ (15.6 °C) = 957 kg/m³

Boiling curve

A preparatory destillation of the tar was not possible. The initial boiling point is to high. A simulated destillation was done by a GC-method. The report is additional as appendix 1.

I.B.P.	303 °C
50 %	473 °C
F.B.P.	> 545 °C

Ultimate analysis

C	85.35 %	Method:	LECO
H	10.50 %		LECO
N	0.16 %		LECO
S	0.33 %		ASTM D 5453-93
O	3.66 %		difference

Water

not detectable with xylol method

Ash

not detectable with EN7

Determination of the Conradson carbon residue (coking tendency), DIN 51551 and ASTM D 189-65

Carbon residue	3.3 %

Solubilities

Toluene insoluble	0.1 %
Heptane insoluble (Asphaltene)	4.0 %
Pentane insoluble	10.8 %

Melting point

51 °C

Calculation of the BMCI

BMCI = 62

5 VALUATION

The BMCI of the tar sample from Neyveli Lignite Corporation Ltd. is very low. Comparatie values from other feedstocks are 125 - 140 for pyrolysis oil, and 140 - 160 for hard coal tar /1/.

The yield of carbon black decreases as the correlation index sinks. The feed of a hydrocarbon mixture with a correlation index of 62 for the production of carbon black is not suitable.

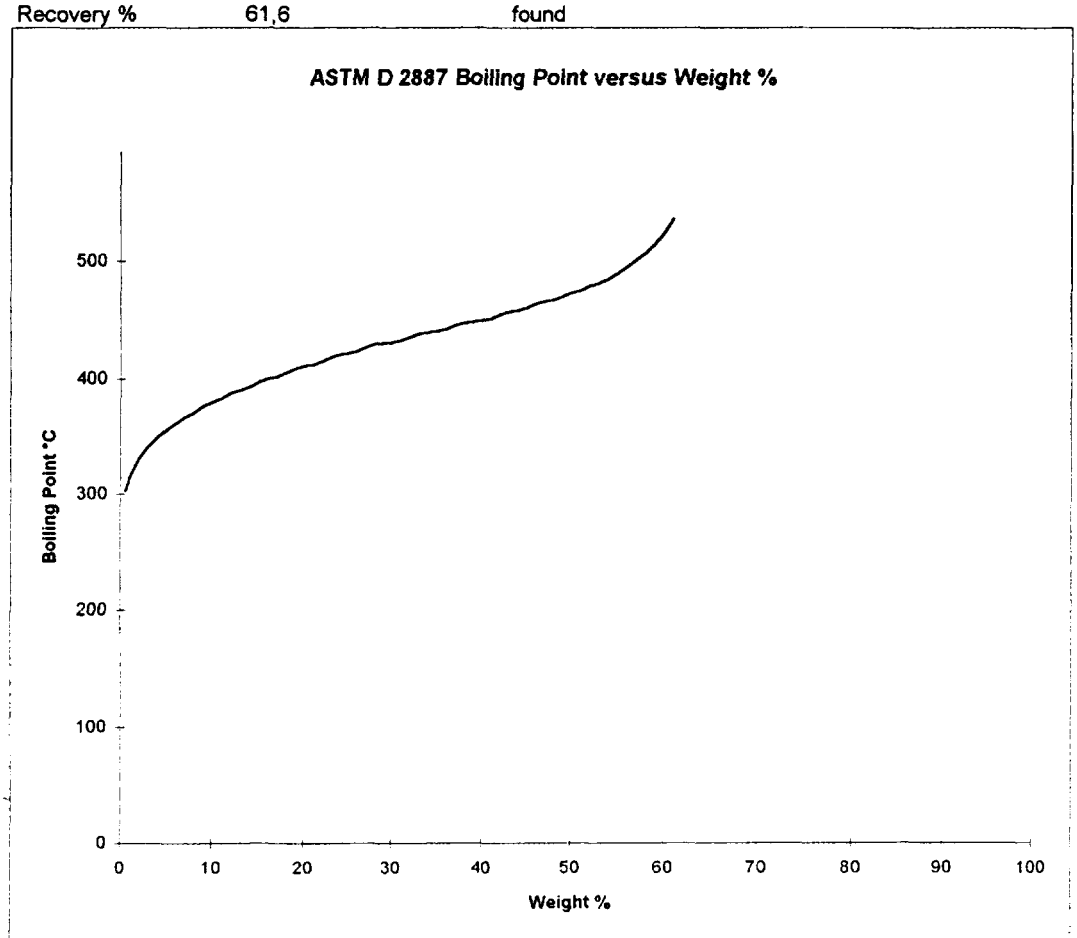
Further investigations were not done.

REFERENCES

/1/ Frank, H.-G., Stadelhofer, J.W.
Industrial aromatic chemistry: raw materials, processes, products: with structural formulas
Berlin, Springer 1988

SIMDIS-HT750-TBP 538

Data File	C:\HPCHEM\1\DATA\D0408A\001F0501.D		
Blank analysis	C:\HPCHEM\1\DATA\D0408A\085F0201.D		
Calibration analysis	C:\HPCHEM\1\DATA\D0408A\090F0301.D		
Reference analysis	C:\HPCHEM\1\DATA\D0408A\095F0401.D		
Instrument name	SIMDIS-HT750-TBP 538		
Operator	ak	Seq. line nr	5
Acquired on	09.04.1997 13:01	Injection	1
Processed at	09.04.1997 15:10	Instrument	1
Sample name	Teer Indien	Vial	1
Method name	MHA21.MTH	Weight sample	0,07
Run type	Sample	Weight CS2	1,725
		Weight ISTD	0
Sequence name	TEER		
Recovery %	61,6	found	



========== AC Software version S2.5 ==========

SIMDIS-HT750-TBP 538 ASTM D 2887 Analyzer

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Data File Name: C:\HPCHEM\1\DATA\D0408A\001F0501.D

Instrument	: 1	Vial	: 1
Operator	: ak	Injection	: 1
Acquired on	: 09 Apr 97 01:01 PM	Seq. line	: 5
Processed on	: 09 Apr 97 3:10 PM		
Sample name	: Teer Indien	Sample Amt:	0.0700
Methodname	: MHA21.MTH	ISTD amt	: 0.0000
Calc. Based On:	ESTD	Weight CS2:	1.7248
Sequencename	: TEER		

Blank used : C:\HPCHEM\1\DATA\D0408A\085F0201.D Corrected
BP Calib. used: C:\HPCHEM\1\DATA\D0408A\090F0301.D
Reference used: C:\HPCHEM\1\DATA\D0408A\095F0401.D

Recovery(%)	: 61.6 found		
Resp. Factor	: 9.161E-11	Threshold set	: 80.0
IBP	: 303.0 C	Start Elution	: 0.00
FBP	: > 545 C	End Elut after:	30.60

Analysis results : %Weight versus Boiling point

%	BP(C)	%	BP(C)	%	BP(C)	%	BP(C)
1	315.5	17	402.0	33	438.0	49	469.5
2	331.0	18	405.5	34	439.5	50	473.0
3	342.0	19	409.0	35	440.5	51	474.5
4	349.5	20	411.0	36	442.5	52	478.5
5	356.0	21	412.0	37	445.5	53	481.0
6	362.0	22	415.0	38	447.5	54	484.5
7	367.5	23	418.5	39	448.5	55	489.0
8	371.0	24	420.5	40	449.5	56	495.0
9	376.5	25	421.5	41	451.5	57	501.0
10	380.0	26	423.5	42	454.5	58	507.0
11	383.5	27	427.0	43	456.5	59	515.0
12	388.0	28	429.5	44	458.0	60	524.5
13	390.5	29	430.5	45	460.0	61	536.5
14	393.5	30	431.5	46	463.5		
15	397.5	31	433.0	47	465.5		
16	400.5	32	435.5	48	466.5		

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Analysis results : Boiling point versus Weight

BP(C)	%	BP(C)	%	BP(C)	%	BP(C)	%
310	0.8	370	7.8	430	28.6	490	55.2
320	1.3	380	10.1	440	34.5	500	56.9
330	1.9	390	12.7	450	40.4	510	58.4
340	2.8	400	15.7	460	45.1	520	59.5
350	4.1	410	19.4	470	49.1	530	60.5
360	5.7	420	23.6	480	52.4	540	61.2

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C:\HPCHEM\1\DATA\D0408A\001F0501.D

Not all time reference peaks were found

Area Percent Report

Data File Name	: C:\HPCHEM\1\DATA\D0408A\001F0501.D		
Operator	: ak	Page Number	: 1
Instrument	: SIMDIS-HT	Vial Number	: 1
Sample Name	: Teer Indien	Injection Number	: 1
Run Time Bar Code:		Sequence Line	: 5
Acquired on	: 09 Apr 97 01:01 PM	Instrument Method:	MHA21.MTH
Report Created on:	09 Apr 97 03:09 PM	Analysis Method	: MHA21.MTH
Last Recalib on	: 07 AUG 91 01:10 PM	Sample Amount	: 0.0700
Multiplier	: 1	ISTD Amount	: 0.0000
Sample Info	: Seq=teer WeightCS2=1.7248 Ref=Ref400 Cal=BP400 Sam=1 Cor=0 Std=1		

Sig. 1 in C:\HPCHEM\1\DATA\D0408A\001F0501.D

Pk#	Ret Time	Area	Height	Type	Width	Area %
1	19.070	2066082	172371	BB	0.184	4.7686
2	19.831	2718844	232824	BB	0.179	6.2752
3	20.562	3822159	314929	BB	0.185	8.8216
4	21.278	4297433	351171	BV	0.184	9.9186
5	21.962	6261924	453328	VV	0.203	14.4527
6	22.631	5550997	389822	VV	0.208	12.8118
7	23.265	6366309	418577	VV	0.219	14.6936
8	23.890	4060804	322789	VB	0.191	9.3724
9	24.487	3614702	303608	BV	0.182	8.3428
10	25.080	2522944	203385	VV	0.191	5.8230
11	25.637	2044950	161440	PB	0.191	4.7198

Total amount = 4.33271E+007

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