

EXTRACTION ENHANCEMENT OF COAL THROUGH  
ACYLATION, ALKYLATION, REDUCTIVE ACYLATION,  
ALKALI TREATMENT AND DEPOLYMERIZATION  
REACTIONS

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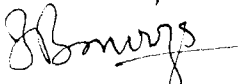
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ABSTRACT

An experimental research programme was undertaken to investigate partial liquefaction of coal through chemical reactions and solvent extraction on laboratory scale. Chemical reactions studied were acylation, alkylation, reductive acylation, alkali treatment and depolymerization employing Assam coal and in some cases Talcher coal also. The aim of present study was focussed at degradation of coal prior to or simultaneous with solvent extraction.

Acylation of coal was conducted using acid anhydrides and carboxylic acids in carbon disulphide and nitrobenzene as solvents respectively. Whenever nitrobenzene was used as a solvent with anhydride or carboxylic acid a product insoluble in reaction mixture was obtained and equivalent extraction of coal on the reaction product was found to be less than that on original coal. Use of carbon disulphide as a solvent for acylation yielded a product partly soluble in reaction mixture and overall it resulted in 35 % coal extraction. Alkylation reactions also resulted in enhanced extraction of coal (30-50 %). Three different techniques were employed to butylate coal and a comparison among them were made. Alkylation of coal was assessed by

checking H/C atomic ratio, extractability and IR spectrum.

The reaction of coal with zinc and acetic acid in phenol could bring about reductive acylation with enhanced extraction of coal in quinoline. Stepwise repeat reactions on residual coal could lead to about 58 % extraction of coal.

Alkali treatment of coals (taking 5-50g of coal) followed by solvent extraction led to increase in extractability. Use of aqueous 1.4 % sodium hydroxide solution was found to be capable of rendering about 50 % coal extractable in ethylene diamine through two alkali treatments followed by extractions. Semibatch operation of alkali treatment yielded about 26-33 % coal extractable and data were comparable with those obtained in batch degradation through a single alkali treatment (on 50g of coals). Of the solvents studied in alkali treatment, polar and basic solvents were found to be better solvents for the process.

It was found that about 60 % of coal was extractable through one step depolymerization (180°C) using phenol and p-toluenesulphonic acid followed by quinoline

extraction. Reduction and alkali treatment prior to the depolymerization of coal yielded more coal extractable in benzene-methanol (low molecular weight products). Use of dry HCl gas and radical initiators was also found to increase the yields of low molecular weight products of coal through depolymerization.

CONTENTS

	<u>Page No.</u>
<u>ACKNOWLEDGEMENTS</u>	I
<u>ABSTRACT</u>	II
<u>CONTENTS</u>	V
<u>LIST OF FIGURES</u>	X
<u>LIST OF TABLES</u>	XIV
<u>CHAPTER 1</u>	
<u>INTRODUCTION</u>	1
<u>CHAPTER 2</u>	
<u>LITERATURE REVIEW</u>	8
2.1	Pyrolysis 8
2.2	Fischer-Tropsch Process 9
2.3	Hydrogenation 10
2.4	Solvent extraction of coal 15
2.4.1	Pett-Broche and related extraction processes 16
2.4.2	Solvent refining of coal 16
2.4.3	Solubilization of coal through molecular grafting 20
2.4.4	Solvolytic liquefaction of coal 20
2.5	Supercritical gas extraction 21
2.6	Depolymerization of coal 21

	<u>Page No.</u>
2.7 Friedel-Crafts alkylation, acylation and related reactions	24
2.8 Reduction and reductive alkylation	26
2.9 Alkaline hydrolysis of coal	
<u>CHAPTER 3</u> <u>EXTRACTION OF COAL THROUGH ACYLATION</u> <u>AND ALKYLATION</u>	30
3.1 Acylation of coal	33
3.1.1 Experimental	34
3.1.1.1 Experimental procedure for acylation	35
3.1.1.2 Quinoline extraction	35
3.1.1.3 Benzene-methanol extraction	36
3.1.2 Results and discussion	37
3.2 Alkylation of coal	47
3.2.1 Experimental	48
3.2.1.1 Alkylation of coal using $AlCl_3$	48
3.2.1.2 Alkylation of coal using dry HCl gas	48
3.2.1.3 Alkylation of coal using p- toluenesulphonic acid	49

		<u>Page No.</u>
	3.2.1.4 Alkylation of coal at plastic stage using liquid paraffin(330-360°C)	50
	3.2.1.5 Analysis of reaction residue	50
	3.2.2 Results and discussion	51
3.3	Conclusions	60
<u>CHAPTER 4</u>	<u>REDUCTIVE ACYLATION</u>	61
4.1	Experimental	62
4.2	Results and discussion	64
	4.2.1 Preliminary data of reductive acylation	64
	4.2.2 Stepwise reductive acylation	69
4.3	Conclusions	77
<u>CHAPTER 5</u>	<u>ALKALI TREATMENT</u>	79
5.1	Experimental	79
	5.1.1 Experimental procedure	80
	5.1.2 Effect of alkali concentration	80
	5.1.3 Alkali treatment in basic medium	81
	5.1.4 Studies with a semibatch reactor	84
5.2	Results and discussion	87
5.3	Conclusions	111

<u>CHAPTER 6</u>	<u>DEPOLYMERIZATION OF COAL</u>	113
6.1	Experimental	114
6.1.1	Experimental procedure	114
6.1.2	Depolymerization followed by reduction of coal	115
6.1.3	Reduction followed by depolymerization of coal	116
6.1.4	Alkali degradation followed by depolymerization of coal	117
6.1.5	Depolymerization in presence of dry HCl gas	117
6.1.6	Depolymerization in presence of promoter	117
6.1.7	Analysis of depolymerized coal	118
6.2	Results and discussion	119
6.2.1	Depolymerization of coal (Direct filtration technique)	119
6.2.2	Depolymerization of coal through bond scission with electrophilic as well as nucleophilic reactions	124
6.2.3	Promoter action on depolymerization of coal	128
6.3	Conclusions	138

CHAPTER 7

CONCLUSIONS

Page No.

139

REFERENCES

143

ABOUT THE AUTHOR

162