Sl .No.	Contents	Page
		No
	List of figures	i
	List of Tables	ii
	Chapter 1	1-30
1.	Introduction	1
1.1	Activated Carbon	1
1.1.1	Activated Carbon and its history	3
1.1.2	World Scenario of Activated Carbon and its demand	6
1.1.3	National Scenario of Activated Carbon	6
1.1.4	Methods for Preparation of Activated carbon	8
1.1.4.1	Physical Activation	8
1.1.4.2	Chemical Activation	8
1.1.4.2.1	Activation with Alkali Metal Hydroxide	9
1.1.4.2.2	KOH as Activating agent	9
1.1.4.2.2	NaOH as Activating agent	10
1.1.5	Microwave Activation	11
1.1.6	Properties of Activated carbon	15
1.1.6.1	Adsorptive characteristics	15
!.1.6.1.1	Surface Area(BET N ₂)	15
1.1.6.1.2	Pore size distribution	16
1.1.6.2	Physical characteristics	17
1.1.6.2.1	Hardness	17
1.1.6.2.2	Bulk density	17
1.1.6.2.3	Particle size distribution	17
1.1.7	Factors to consider for promoting activated carbon use	18
1.1.7.1	Effect of particle size and activation temperature	18
1.1.7.2	Factors that affect the char yield and carbon content of the activated	18
	carbon	
1.1.8	Major Use of Activated Carbon	19
1.1.8.1	Water purification	19

1.1.8.2	Air purification	20
1.1.8.3	Energy storage	21
1.1.8.4	Adsorptive Desulphurization potential of Adsorbent and Calgon	22
	based Carbon Materials	
1.1.9	What is coal and its abundance in North East	22
1.1.9.1	Characteristics of NER coals	24
1.1.10	Bamboo in the North-East India as a source for activated carbon	27
1.1.10.1	Characteristics of NER bamboos	27
1.1.10.1.1	Physical characteristics	28
1.1.10.1.2	Chemical characteristics	28
1.1.11	Rationale behind the work	29
1.1.12	Objectives	30

Chapter 2	31-44

45-54

2.	Literature Review	31
2.1	Study on carbonization	31
2.2	Study on Preparation of activated carbon	31
2.3	Study on Characterization of activated carbon	38
2.4	Study on preparation of advanced materials	42

3	Materials and methods	45
3.1	Sample collection site	45
3.2	Description of the species	45
3.2.1	Botanical Name	45
3.2.2	NER coal	46
3.3	Analytical Methods	46

Chapter 3

3.3.1	Proximate analysis of coal	46
3.3.2	Proximate analysis of bamboo	48
3.3.2.1	Determination of moisture content	48
3.3.2.2	Determination of ash content	48
3.3.2.3	Determination of volatile matter	49
3.3.2.4	Determination of fixed carbon	49
3.3.3	Determination of calorific value	49
3.3.4	Determination of cellulose, hemicelluloses and lignin content of	50
	bamboo	
3.3.5	Thermogravimetric analysis (TGA) and Differential thermo-	50
	gravimetric analysis for raw samples(coal and bamboo)	
3.4	Carbonization experiment	51
3.4.1	Determination of proximate analysis of char obtained from coal and	51
	bamboo	
3.4.2	Determination of carbon, hydrogen, nitrogen of coal, bamboo and	51
	char obtained from coal and bamboo	
3.5	Preparation of activated carbon	52
3.1.6	Physico-chemical characteristics of activated carbon	53
3.6.1	Scanning Electron Microscope (SEM) analysis	53
3.6.2	Fourier Transform Infrared Spectroscopy(FTIR) analysis	53
3.6.3	Determination of Iodine number	53
3.6.4	X-Ray Diffraction(XRD) analysis	54
3.6.5	Determination of porosity	54

55-69

4.	Results and discussion	55
4.1	Sample collection	55
4.2	Proximate analysis of the samples	55
4.2.1	Analysis of moisture content, ash, volatile matter, fixed carbon and	55
	calorific value	
4.3	Analysis of cellulose, hemicellulose, lignin	56
4.4	Ultimate analysis of the samples	56

-

4.4.1	Analysis of carbon, hydrogen, nitrogen for bamboo and coal sample	56
4.5	Thermo-gravimetric (TGA) and Differential thermo-gravimetric	57
	(DTG) analysis of bamboo and coal	
4.6	Preparation of charcoal/coke	60
4.6.1	Proximate analysis of charcoal/coke	60
4.6.1.1	Analysis of moisture content, ash, volatile matter and fixed carbon	60
	of charcoal, coke	
4.6.2	Ultimate analysis of charcoal, coke and activated carbon from	61
	bamboo and coal	
4.6.2.1	Analysis of carbon, hydrogen, nitrogen of charcoal, coke and	61
	activated carbon from bamboo and coal	
4.7	Fourier Transform Infrared Spectroscopy study of raw material,	63
	carbonized sample and activated carbon from bamboo and coal	
4.8	AdsorptionStudy of carbonized sample and activated carbon from	65
	bamboo and coal	
4.9	Pore volume study of carbonized sample and activated carbon from	65
	bamboo and coal	
4.10	X-Ray Diffraction study of raw material, carbonized sample and	66
	activated carbon from bamboo and coal	
4.11	Scanning Electron Microscopic (SEM) examination of bamboo and	68
	coal and activated carbon from bamboo and coal	
	Chapter 5	70-71
	Conclusions	70

References

72-79

SI.	List of figures	Page No
No.		
1.1	Sector wise demand of activated carbon	7
1.2	State wise coal availability	24
3.1	Bamboosa balcooa	45
3.2	Sub-bituminous coal	46
4.1	TGA of bamboo	57
4.2	DTG of bamboo	57
4.3	TGA of coal	58
4.4	DTG of coal	59
4.5	FTIR of bamboo (raw), carbonized bamboo(CB) and	63
	activated carbon(AC) from bamboo	
4.6	FTIR of coal(raw), carbonized coal(CC) and activated	64
	carbon(AC) from coal	
4.7	XRD pattern of bamboo(raw), carbonized bamboo(CB) and	66
	activated carbon (AC) from bamboo	
4.8	XRD pattern of coal(raw), carbonized coal(CC) and	67
	activated carbon(AC) from coal	
4.9	SEM image of the sample studied	69

SI.	List of tables	Page
No.		No.
1.1	Carbonization and activation conditions of biomass precursors	2
1.2	Production of activated carbon in terms of activation, process, precursors	5
1.3	Types of activated carbon and its applications	7
1.4	Characteristics of surface area of activated carbons prepared with different	12
	activation agent using microwave techniques	
1.5	Comparison between activation process, heating method and activation	14
	time for the preparation of activated carbon and reported with other	
	literature date under optimum conditions	
1.6	IS Standard Specifications for Drinking Water	20
1.7	Carbon source with capacitance from natural renewable precursors for	22
	EDLC electrodes	
1.8	Physico-chemical analyses of NER coals.	26
1.9	Proximate analysis of bamboo	29
1.10	Biochemical analysis of bamboo	29
1.11	Ultimate analysis of bamboo	29
4.1	Collected species	55
4.2	Proximate analysis of bamboo and coal sample and calorific value	55
4.3	Biochemical properties of bamboo sample	56
4.4	Ultimate analysis of bamboo and coal sample	56
4.5	Percentage of yield produced from bamboo and coal species at four	60 .
	different temperatures with a heating rate of 5° C/min.	
.4.6	Proximate analysis of charcoal, coke and activated carbon from bamboo	61
•	and coal	
4.7	Ultimate analysis of charcoal, coke and activated carbon from bamboo and	62
	coal	
4.8	Iodine number of bamboo and coal (before and after activation)	65
4.9	Pore volume of bamboo and coal (before and after activation)	66

· ·