

**PROJECT PROFILE**  
**ON**  
**ACTIVATED CARBON**

**MONTH & YEAR**  
**JULY 2011**

**PREPARED BY**  
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# ACTIVATED CARBON

## A. INTRODUCTION

Activated carbon is a non-graphite form of carbon which could be produced from any carbonaceous material such as coal, lignite, wood, paddy husk, coir pith, coconut shell, etc

Activated carbon is a unique and effective agent for purification and for isolation and recovery of trace materials.

During the last two to three decades, treatment with active carbon has become an important unit process for separations and purifications in the food, pharmaceuticals, sugar, chemical and other processing industries.

## B. PRODUCT USES AND SPECIFICATIONS

Removal of colour or odour, oxidising chemicals, compounds responsible for foaming, metallic ions which constitute impurity and invisible impurities,

To improve product stability and to provide better crystallisation.

For recovery of valuable materials, to enhance purity, to improve the appearance of product and to act as barrier to prevent migration of colour bodies.

### Grade wise application

Grade	Sector
Powdered Activated carbon	Vegetable oils, fats, sugar, water treatment, pharmaceuticals, fine chemicals and food products.
Granular Activated carbon	Automotive canisters, air purification, chemical and pharmaceutical industry.
Pelletised Activated carbon	Solvent recovery, catalyst application etc

**Activated carbon**, also called **activated charcoal** or **activated coal**, is a form of carbon that has been processed to make it extremely porous and thus to have a very large surface area available for adsorption or chemical reactions. The word *activated* in the name is sometimes substituted by *active*. Due to its high degree of microporosity, just one gram of activated carbon has a surface area of approximately 500 m<sup>2</sup>, as determined typically by nitrogen gas adsorption. Sufficient activation for useful applications may come solely from the high surface area, though further chemical treatment often enhances the adsorbing properties of the material. Activated carbon is usually derived from charcoal.

### **Product Specification**

Chemical parameters	Acid washed	Unwashed
Moisture (%) max.	10	10
Methylene value(min)	270	280
KMnO <sub>4</sub> (min)	60	60
Iodine value	1100	1100
Ash(%) max.	5	NA
Fe ppm	200	1000
pH	6.5 to 7.2	Adjustable
Chlorine(%) max	0.4	NA
Sulphate(%) max	0.4	NA
Phosphate	Nil	Nil
Acid soluble matter (%)	1.5	5
Water soluble (%)	0.5	4
Bulk density	4 to 6 gm/cc	4-6 gm/cc

### **C. MARKET POTENTIAL**

GIA (Global Industry Analysts Inc) a leading market analyst announces the release of a comprehensive global report on Activated Carbon market in April 2011. The global market for activated carbon is forecast to reach a market size of 2.3 million metric tons by the year 2017, energized mainly by the anticipated spurt in demand for activated carbon in the US market. Stringent federal environmental regulations over removal of mercury at coal, power and other industrial plants are forecast to stimulate demand over the long-term. End-use application areas of air purification, water treatment and medical & pharmaceutical will drive dramatic growth in the US and Asia-Pacific markets through 2017. In future, the focus will increasingly shift to developing markets, led by Asian countries of China and India, Latin America and Middle East.

The activated carbon is extensively used in the refining and bleaching of vegetable oils and chemical solutions, water purification, recovery of solvents and other vapours, recovery of gold, in gas masks for protection against toxic gases, in filters for providing adequate protection against war gases/ nuclear fall outs, etc.

The activated carbon installed capacity is estimated at about 1200000 tones per annum in India. The current production is estimated at about 90000 tonnes per annum. There are about 70 manufacturers of activated carbon in India and they are mostly in small and medium scale. The growth rate in this sector is estimated at about 8% per annum and there is a continuous demand growth due to large scale industrial activities. A part of the demand is also met by imports. Due to the expansion of pharmaceutical and vegetable oil industry, the demand of activated carbon is expected to rise sharply in coming years. It has bright future for exports also.

The sector wise demand of the activated carbon is as follows:

Sector	Percentage of Consumption
Pharmaceuticals	6%
Plasticizers	4%
Glucose/Dextrose monohydrate /Sorbitol	3.5%
Vegetable oils	73.2%
Other miscellaneous sector	13.3%

## **D. TECHNICAL ASPECTS**

### **1. INSTALLED CAPACITY**

The installed capacity of the unit is 300 Tonnes of Activated Carbon per annum on three shift basis, 8 hours per day, for 300 days.

### **2. PLANT AND MACHINERY**

The following items of equipment are required.

No	Description
1	Jaw crusher
2	Hammer mill
3	Vibratory feeder
4	Elevator
5	Carbonization kiln
6	Soaking tanks
7	Cyclones
8	Rotary kiln with heat recovery unit
9	Coolers
10	Centrifuge
11	Rotary drier
12	Micro Pulveriser

13	Sieving machine
14	Pneumatic filling machine
15	Boiler
16	Tanks
17	Water storage, Fuel storage
18	Laboratory equipments
19	Generator
20	Effluent treatment

The total value of the plant and machinery is estimated at Rs.100.00 lakhs on a turnkey basis.

### **3. MANUFACTURING PROCESS**

The process of manufacturing Activated carbon involves the following sequence of operations.

Activated carbon manufactured from coconut shell is considered superior to those obtained from other sources mainly because of small macropores structure which renders it more effective for the adsorption of gas/ vapour and for the removal of colour and odour of compounds.

Steam activation and chemical activation are the two commonly used processes for the manufacture of activated carbon. However coconut shell based activated carbon units are adopting the steam activation process to produce good quality activated carbon.

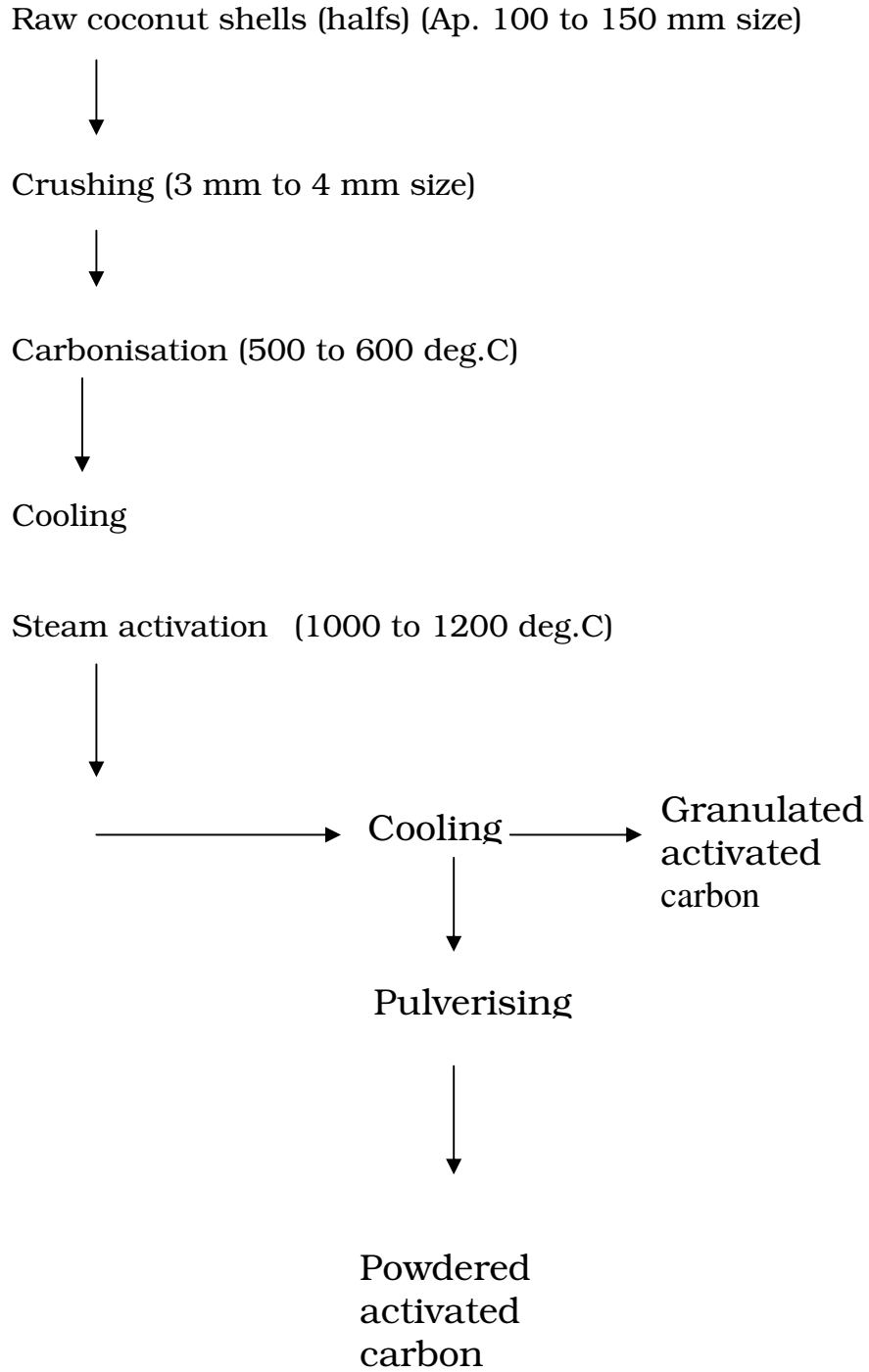
Activated carbon can be produced from any carbonaceous material, which on activation attain porous structure and consequently a large surface area.

Raw materials such as wool, lignite, woods, coconut-shells, agricultural waste like bagasse, rice husk are generally used for the manufacture of Activated carbons. Raw materials having high carbon and low ash content are preferred.

Coconut shell has been found to be most suitable raw material for making gas adsorption grade Activated carbon. The shell char is activated with direct steam and fired with liquid fuel in temperature of 1000 to 12000 deg.C in specially designed rotary kiln in controlled conditions to obtain granulated activated carbon.

The process of activation is carried out in two stages. Firstly the coconut shell is converted into shell charcoal by carbonization process which is usually carried out in mud-pits, brick kilns and metallic portable kilns. The coconut shell charcoal is activated by reaction with steam at a temperature of 900°C - 1100°C under controlled atmosphere in a rotary kiln. The reaction between steam and charcoal takes place at the internal surface area, creating more sites for adsorption. The temperature factor, in the process of activation is very important. Below 900°C the reaction becomes too slow and is very uneconomical. Above 1100°C the reaction becomes diffusion controlled and therefore takes place on the outer surface of the charcoal resulting in loss of charcoal.

**Process flow sheet for Activated carbon from Coconut shells by steam activated process**





#### **4. RAW MATERIAL**

1000 kg of raw coconut shells yield about 100 kgs of vapour grade activated carbon.

About 90000 shells are required for one tonne of activated carbon-110 grams per coconut shell.

#### **5. LAND & BUILDING**

Land required- About an acre – Cost Rs.15.00 lakhs.

Building Area -5000 sq.ft Cost Rs.40.00 lakhs

#### **6. UTILITIES**

##### **Power:**

The total power requirement of the unit will be 70 HP. Fuel requirement is 400 litres per day.

##### **Water:**

Water is required only for human consumption

##### **Man power:**

Category	Nos.	Monthly Salary	Total monthly Salary
Supervisor	3	9000	27000
Skilled	3	7000	21000
Helpers	9	5000	45000
Assistant	3	6000	18000
			<hr/>
			111000
Add : Benefits	20%		22200
			<hr/>
Total			133200
			<hr/>
Total wages per annum [Rs. lakhs]			Rs.15.98 lakhs

## 7. IMPLEMENTATION SCHEDULE

After making arrangements for the finance, the project can be implemented within six months period.

## 8. ASSUMPTIONS

Installed capacity per annum	Activated Carbon-300 MT
Capacity utilization-Year -1	60%
Year-2	70%
Year-3	80%
Selling price per unit	Rs.90000 /MT
Raw materials	Rs 67.50 lakhs per annum
Consumables / packing materials	Rs 9.00 lakhs per annum
Power and Fuel-100% (Rs. lakhs)	Rs.65.72 lakhs
Wages & salaries -100% (Rs. lakhs)	Rs.15.98 lakhs annual increase 5%
Repairs & Maintenance- p.m.	Rs.2.40 lakhs per annum
Depreciation	Written down value Method
General & administration Expenses per month	Rs.80000/- per month
Selling expenses	3% on Sales
Interest on term loan and Working capital finance	14% p.a.
Income tax provision	34% on profit

## TECHNICAL KNOW HOW SUPPLIERS

1. Ecofresh Carbons 70 A, Palayamkottai Road, 3rd Mile, Opposite To Church, Tuticorin - 628008, Mr.Suresh: 9443774724- - 0461-2312621

2. Indian Institute of Chemical Technology

Uppal Road Hyderabad, AP

Phone: 91-40-27160123(20 lines)

<http://www.iictindia.org>

## LIST OF MACHINERY SUPPLIERS

Name of the equipment	Name of the company
Reactors	Chemitherm Plants & Systems P. Ltd., 30, Anandha Street Alwarpet, Chennai-600 018  Texel Fabricators Pvt. Ltd., 335, Sidco Industrial Estate, Ambattur, Chennai-600 098, Tamil Nadu
Pulveriser	ACE Pack Machines 23, V.N. Industrial Estate Bharathi Colony, Near Athiparasakthi Temple Peelamedu, Coimbatore-641 004  Frigmaires Engineers PO Box 16353, 8, Janata Industrial Estate Senapati Bapat Marg Opp Phoenix Mill, Lower Parel (W) Mumbai-400 013

Rotary Kiln	<p>Veasons Boiler Engineers C-14/2, Industrial Estate, Trichy-620 015</p> <p>Nadi Airtechnics EBM - Nadi International Pvt. Ltd. (An Indo-German Joint Venture) 26 and 26/3, G.N.T. Road, Erukkencherry, Chennai-600 118, Tamil Nadu</p>
Tray dryer	<p>Richard Engineering (Bombay) Pvt. Ltd. 42, IIF, Veerabadran Street Near Valluvar Kottam Nungambakkam, Chennai-600 034</p> <p>Ganson Ltd. 645, Anna Salai, Chennai-600 006</p>
Boilers	<p>Cethar Vessels Ltd., No.4, Dindigul High Road, Trichy</p> <p>Firetech Boilers Pvt. Ltd. No.211, 2nd Cross, 38th Main, B.T.M. Layout 2nd Stage, Bangalore-68</p>

Pelletising unit	<p>Excel Industrial Services  White House, D-111/8, Ist Main Road,  Anna Nagar (East)  Chennai-600 102</p> <p>Richard Engineering (Bombay) Pvt. Ltd.  42, IIF, Veerabadran Street  Near Valluvar Kottam  Nungambakkam, Chennai-600 034</p>
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**LIST OF RAW MATERIAL SUPPLIERS**

Coconut shells can be procured from oil mills and coconut growing centres through brokers and dealers.

## FINANCIAL ASPECTS

### 1. COST OF PROJECT

	[Rs.lakhs]
Land	15.00
Building	40.00
Plant & Machinery	100.00
Technical know how fees	2.50
Other Misc. assets	5.00
Pre-Operative expenses	15.00
Margin for WC	3.32
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	180.82
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### 2. MEANS OF FINANCE

Capital	64.82
Term Loan	116.00
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	180.82
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### 3. COST OF PRODUCTION & PROFITABILITY STATEMENT

	[Rs.lakhs]		
Years	1	2	3
Installed Capacity (MT)	300	300	300
Utilisation	60%	70%	80%
Production/Sales (MT)	180	210	240
Selling Price per MT	Rs.90,000		
Sales Value (Rs.lakhs)	<hr/> <b>162.00</b>	<hr/> <b>189.00</b>	<hr/> <b>216.00</b>
Raw Materials	40.50	47.25	54.00
Packing materials	5.40	6.30	7.20
Power & fuel	39.43	46.00	52.58

Wages & Salaries	15.98	16.78	17.62
Repairs & Maintenance	2.40	2.64	2.90
Depreciation	15.88	13.52	11.52
Cost of Production	119.59	132.49	145.82
Admin. & General expenses	9.60	10.08	10.58
Selling expenses	4.86	5.67	6.48
Interest on Term Loan	16.24	14.21	10.15
Interest on Working Capital	2.32	2.32	2.32
Total	152.61	164.77	175.35
Profit Before Tax	9.39	24.23	40.65
Provision for tax	3.19	8.24	13.82
Profit After Tax	<b>6.19</b>	<b>15.99</b>	<b>26.83</b>
Add: Depreciation	15.88	13.52	11.52
Cash Accruals	22.07	29.51	38.35

#### 4. WORKING CAPITAL:

	Months	Values	%	Margin	Bank
	Consumptions			Amount	Finance
Raw Materials	1.00	3.38	25%	0.85	2.53
Finished goods	0.25	2.49	25%	0.62	1.87
Debtors	1.00	13.50	10%	1.35	12.15
Expenses	1.00	0.50	100%	0.50	0.00
		19.87		3.32	16.55

#### 5. PROFITABILITY RATIOS BASED ON 80% UTILISATION

<u>Profit after Tax</u>	=	<u>26.83</u>	12%
Sales		216.00	
<u>Profit before Interest and Tax</u>	=	<u>53.12</u>	27%
Total Investment		197.37	
<u>Profit after Tax</u>	=	<u>26.83</u>	41%
Promoters Capital		64.82	

## 6. BREAK EVEN LEVEL

Fixed Cost (FC):

	[Rs.lakhs]
Wages & Salaries	17.62
Repairs & Maintenance	2.90
Depreciation	11.52
Admin. & General expenses	10.58
Interest on TL	10.15
	<hr/>
	52.77
	<hr/>

Profit Before Tax (P) 40.65

$$\text{BEL} = \frac{\text{FC} \times 100}{\text{FC} + \text{P}} = \frac{52.77}{93.42} \times \frac{80}{100} \times 100$$

45% of installed capacity