

Pitch Cutting in Tar Distillation Plant of COCCP

1.0 Introduction

Visakhapatnam Steel Plant Produces Coke from Metallurgical Coal by heating in the Coke Oven Batteries in the absence of Oxygen. The volatile matter and Moisture in the Coal gets evaporated. The details of the Coke Oven Battery and other ancillary plants are detailed below. This coke is used in Blast Furnace

2.0 COKE OVENS AND COAL CHEMICALS PLANT

2.1 BATTERY:

The prepared coal charge from the coal tower is drawn by a charging car on the top of the batteries and charged into the ovens as per sequence. The charged coal is gradually heated by the heating walls of the oven in the absence of air to attain a temperature of 1000-1050°C at the central axis of the coke mass towards the end of coking period. The coking period is generally specified between 16 hrs to 19 hrs depending upon oven condition and production requirement. The volatile matter of coal liberated during carbonization is collected in gas collecting mains in the form of raw coke oven gas passing through stand pipes and direct contact cooling with ammonia liquor spray. The gas cooled from 800°C to 80°C is drawn to coal chemicals plant by Exhauster.

The residual coke is pushed out of the oven by pusher car through a guide into coke bucket. The red-hot coke is taken to coke dry cooling plant for cooling.

There are 5 batteries, each having 67 ovens. Each oven can hold 32 tons of dry coal charge. The volumetric capacity of each oven is 41.6 m³.

The heat for carbonization is supplied by under firing of coke oven gas having CV of 4200 Kcal/Nm³ or mixture of BF gas & CO gas having CV 1000 Kcal/Nm³.

The heating system of batteries is of under jet compound type having twin-heating flues with recirculation of waste gases. The dimensions of an oven are as follows.

a) General Dimensions:

Length 16,000 mm

Height 7,000 mm
Width on coke side 435 mm
Width on pusher side 385 mm
Average width 410 mm
Oven taper 50 mm

2.2 COAL CHEMICALS PLANT :

The main by product in the process of coke making is raw coke oven gas and this has lot of valuable chemicals. Coal Chemicals Plant recovers Ammonia (NH_3), Tar and crude Benzol from Co-Gas as the primary By-products from Crude CO Gas are Ammonium Sulphate $(\text{NH}_4)_2\text{SO}_4$, Crude Tar, Crude Benzol and cleaned coke oven gas.

QUALITY AND COMPOSITION OF COKE-OVEN GAS

Calorific value	Kcal/N.cum	4300-4350
Density	kg/Nm ³	0.45
CmHn	%	2.8
O ₂	%	0.5 (max)
CO	%	6.4 - 7.0
H ₂	%	59 - 61
CH ₄	%	25 - 26
N ₂	%	3.0-3.5

Yields of main Carbonization by-products based on coal are follows (percent on dry blend basis).

Crude Tar 3.2 % , Ammonia (NH_3) 0.3% or 7-10 gm/Nm³ of coke oven gas

Crude Benzol 0.6% or 20 gm/Nm³ of coke oven gas

Generation of coke oven gas per ton of dry coal charged is 330-350 Nm³ at calorific value of 4300 Kcal/Nm³

GAS CONDENSATION SECTION :

The Coke Oven Gas (CO Gas) leaves the ovens at a temperature of 800 deg C and is cooled from 800 Deg. C in goosenecks and in gas collecting mains at the batteries by spraying Ammonical liquor (Flushing liquor). 60-70% of Tar present in CO-Gas is condensed here. The CO-Gas along with Tar and liquor comes to a separator to remove liquor and condensed Tar. The cooled CO-Gas is then taken to primary gas coolers (each having a heat transfer area of 2425m²) where it is cooled indirectly

by water to about 25 to 300C. Along with the Tar, some amount of Naphthalene in coke oven gas is also condensed.

The gas is then sent to Electro Static Precipitators (each of 27000 Nm³/hr capacity) to remove the foggy Tar (about 5%) from CO gas. In ESP, foggy Tar particles are electrically charged and collected on the surface of the electrodes and separated. The gas purified from Tar is compressed in Exhauster to a pressure of max.2800 mm water column. There are five electrically driven exhausters provided and each having capacity of 76000 Nm³/hr.

Tar and Ammonia Liquor (Flushing liquor) from the separator are delivered to mechanized decanters , each of having capacity of 370 m³. Here the crude Tar, Flushing liquor and sludge (coal and coke dust particles in Tar) are separated based on their density difference. The separated flushing liquor from decanter is collected in Tanks of capacity of 200 m³ from where it is pumped continuously by flushing liquor-pump to gooseneck and gas collecting mains of coke ovens. There are 8 Nos. of Flushing liquor pumps of having capacity of 1100 m³/hr.

Tar separated from the decanters is collected in an intermediate Tar tank of having capacity of 50 m³ from where it is once again pumped to Tar decanters (each of capacity 370 m³), which are exclusively provided to remove further water from Tar. The gas condensate which is collected after the primary gas coolers, Electrostatic precipitators and exhauster is taken to a underground 50 m³ tank from where it is pumped to Tar Decanters for separation. The flushing liquor separated from Tar decanters is collected in Flushing liquor tanks. The clear Tar taken in another 50 m³ tank from where it is pumped to final gas cooler.

2.3 TAR DISTILLATION PLANT:

It is designed to process 1, 15, 200 Ton/year of Tar. The crude tar having maximum water content 5% is heated in the pipe still furnace to 115 Deg. C and sent to the 1st stage Evaporator, where the Tar is separated from water and stored as dehydrated Tar. Further, this Tar is heated in the pipe still up to 400 Deg. C and taken to the 2nd stage evaporator. Here the vapors and the residues (called pitch with softening temperature 67 to 730C) are separated and this vapor is sent to the Rectification Column. All the products are withdrawn at different levels based on their boiling points difference and cooled and stored.

Pitch or Residue at the bottom of the 2nd stage evaporator is soft in nature and it is made hard by sending compressed air in pitch reactors. Due to the polymerization and condensation, which takes

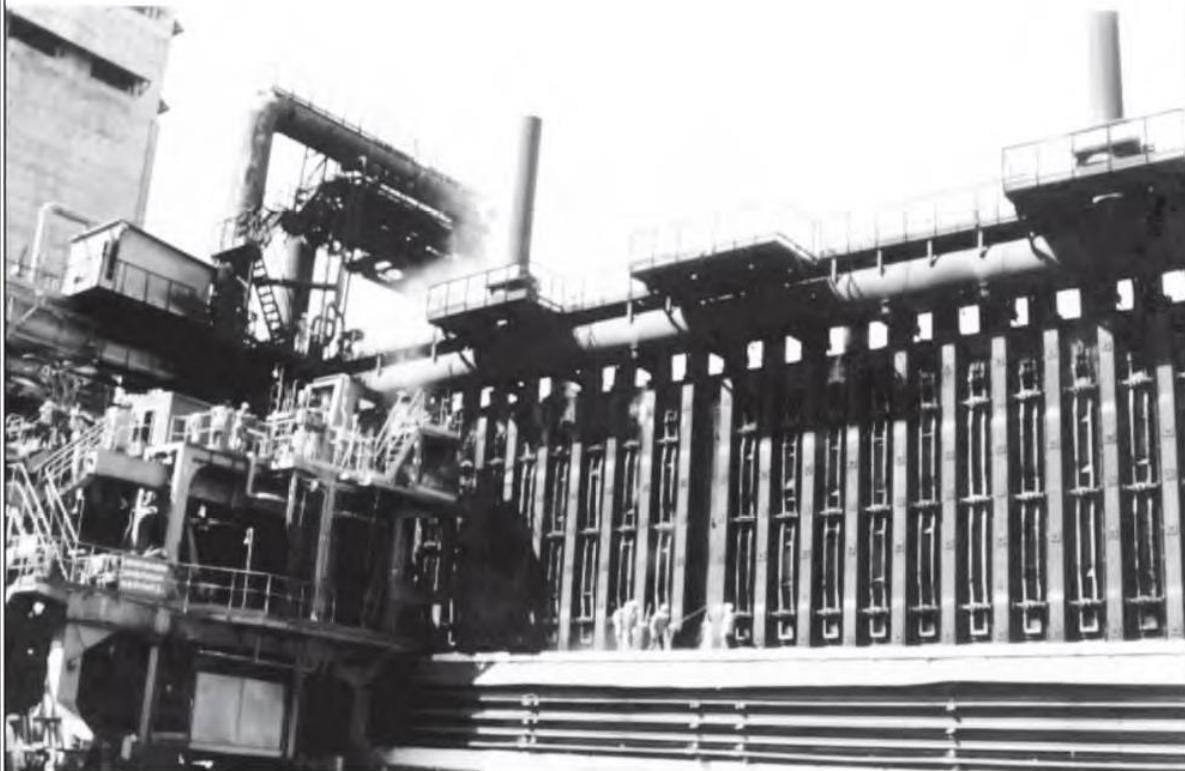
place in the reactor, the pitch becomes harder and withdrawn from the reactor. Pitch creosote mixture is prepared by mixing soft pitch and Anthracene Oil.

The Black Pitch produced in the Coke Oven Plant is poured in an open areas as a bed. The pitch will be slightly hot condition and semi-solid condition. As the days passes the pitch gets hardened and temperature also comes down to ambient temperature. This is mainly used for making BT Roads and also it can act as a fuel to fire furnaces within the plant.

3.0 Pitch Cutting – Present Scenario: Presently the pitch is cut and loaded into the trucks using manual process. The humans climb on to the pitch bed and cut the pitch using drills/crow bars and transported manually to the trucks and loaded. This process is very hazardous as at times the fumes till will be emanating from the pitch bed and even some times the pitch is not fully solid.

4.0 Required Solution: Robots may be designed to cut the pitch, bagging and transport the same in trucks.

COKE OVEN





Tar Pond



Pitch Cutting Tools



Figure 1 Pitch Cutting in Progress