



# **SNS COLLEGE OF TECHNOLOGY**

Vazhiampalayam, Coimbatore-35

**(An Autonomous institution)**

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## **DEPARTMENT OF CHEMISTRY**

**COURSE NAME : 23CHT102- CHEMISTRY OF ENGINEERING  
MATERIALS**

**I YEAR / II SEMESTER**

**UNIT : 3. FUELS AND COMBUSTION**

**TOPIC : 2. SOLID FUEL-COAL- MANUFACTURE**



# BRAINSTORMING WITH RECAP



# COAL



- Coal is a fossil fuel
- produced from large accumulation of vegetable debris / partial decompose
- modification by the action of heat & pressure over millions of years.
- Coal is a highly carbonaceous matter
- Formed under certain favorable conditions
- Alteration of vegetable matter (e.g., plants).
- In addition to noncombustible inorganic matter, it is mainly C, H, N, and O<sub>2</sub>.





# CLASSIFICATION OF COAL



- Coal is classified on the basis of its rank.
- Degree or level of maturity carbon contents.
- Based on the amount of C, O<sub>2</sub>, and H<sub>2</sub> in coal.
- Coalification----- wood -----anthracite.

Wood ---- peat---- lignite---- bituminous ---- anthracite.







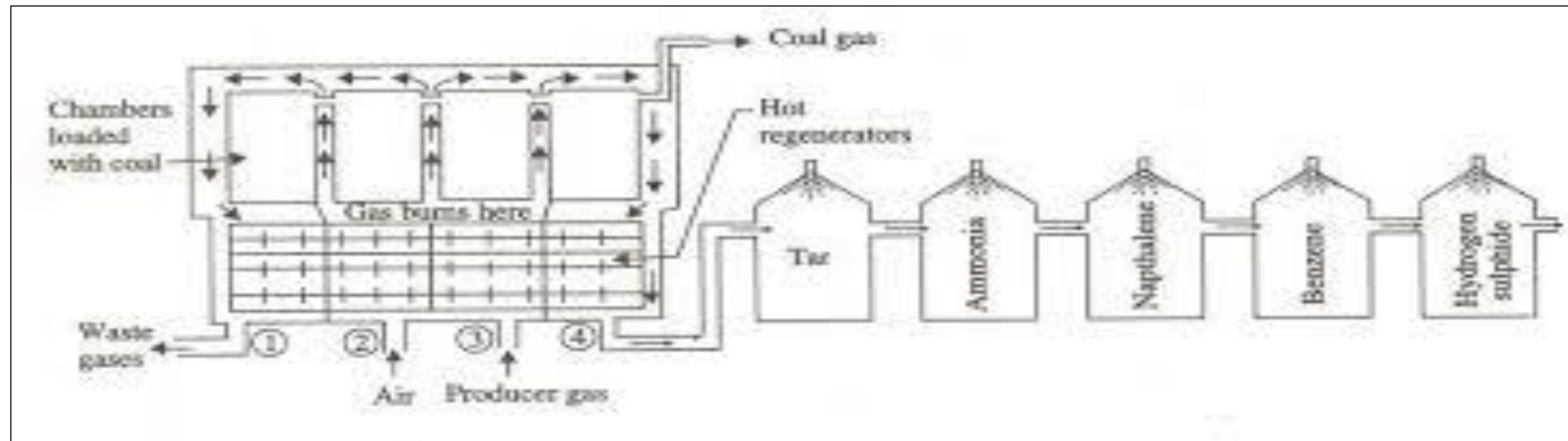
# MANUFACTURE OF COAL BY OTTO HOFFMANN METHOD



**In order to:**

- (1) increase the thermal efficiency of the carbonization process, and
- (ii) recover valuable by-product (like coal gas, ammonia, benzol oil, tar, etc.),

Otto Hoffman developed modern byproduct coke oven.



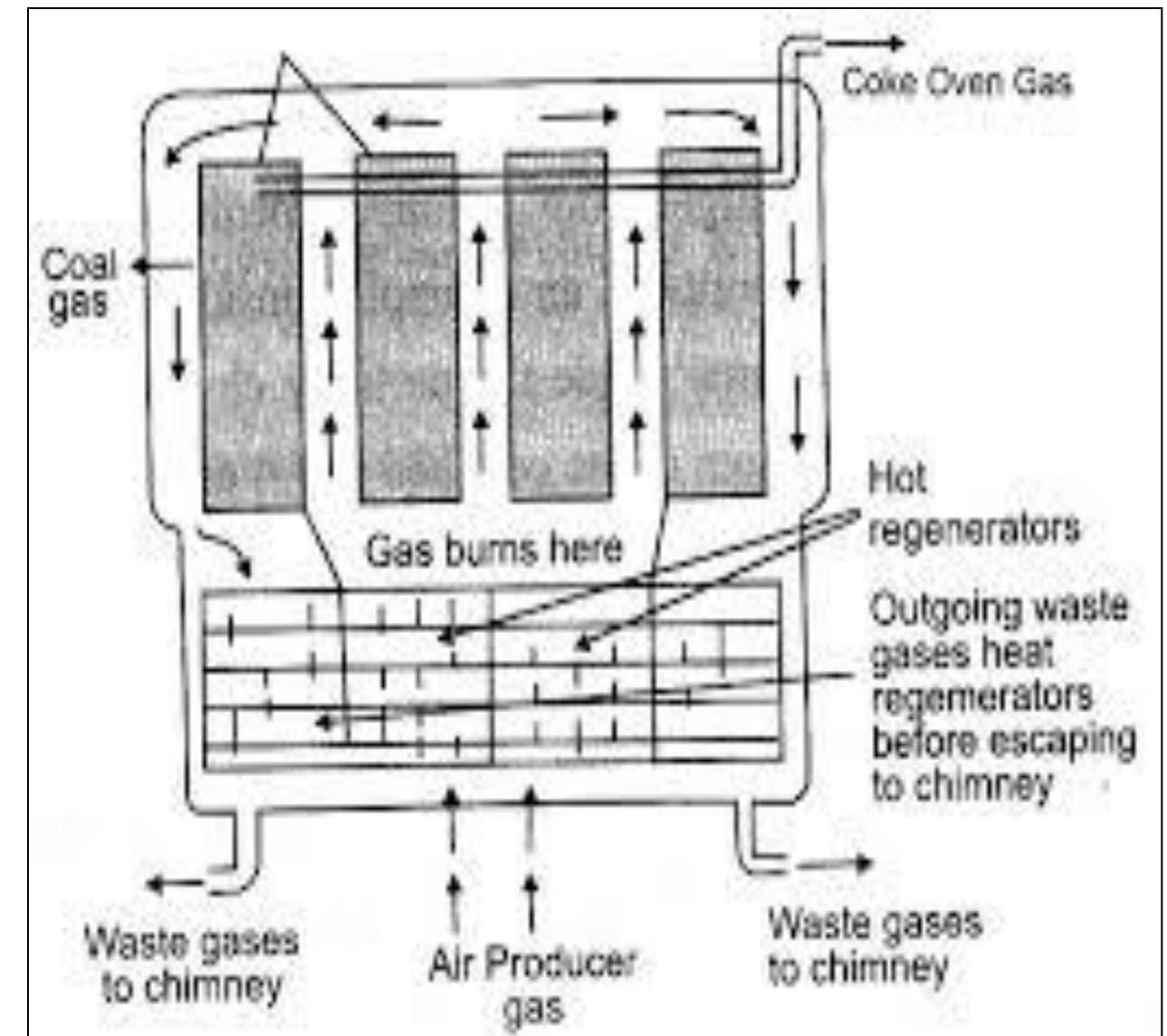


# MANUFACTURE OF COAL BY OTTO HOFFMANN METHOD



## Construction

- The oven consists of a no. of narrow silica chambers
- Each about 10-12 m long, 3-4 m tall and 0.4-0.45 m wide.
- Each chamber has a hole at the top to introduce the charge.
- Gas off take valve
- Refractory lined cast iron door at each end for coke discharge.





# Activity





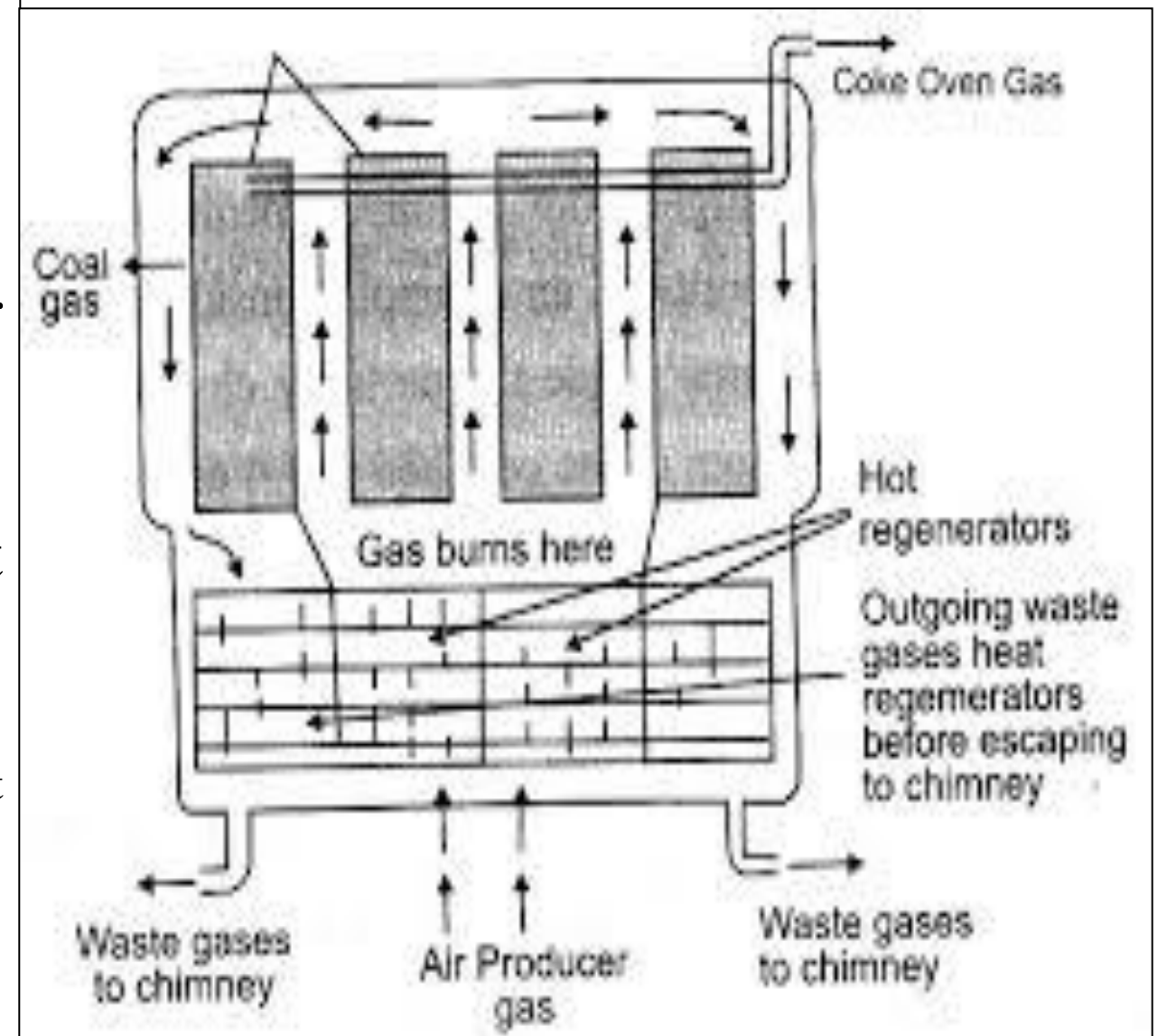


# MANUFACTURE OF COAL BY OTTO HOFFMANN METHOD



## Working:

- Coal is fed silica chamber and closed.
- The chambers are heated to  $1200^{\circ}\text{C}$  - pre heated air & the producer gas mixture between the chambers.
- The air & gas are preheated –sending through 2<sup>nd</sup> and 3<sup>rd</sup> hot generators.
- The hot flue gases produced during combustion are pass through 1<sup>st</sup> and 4<sup>th</sup> generators until the temperature has been raised to  $1000^{\circ}\text{C}$ .
- Alternatively passed the heated hot flue gases



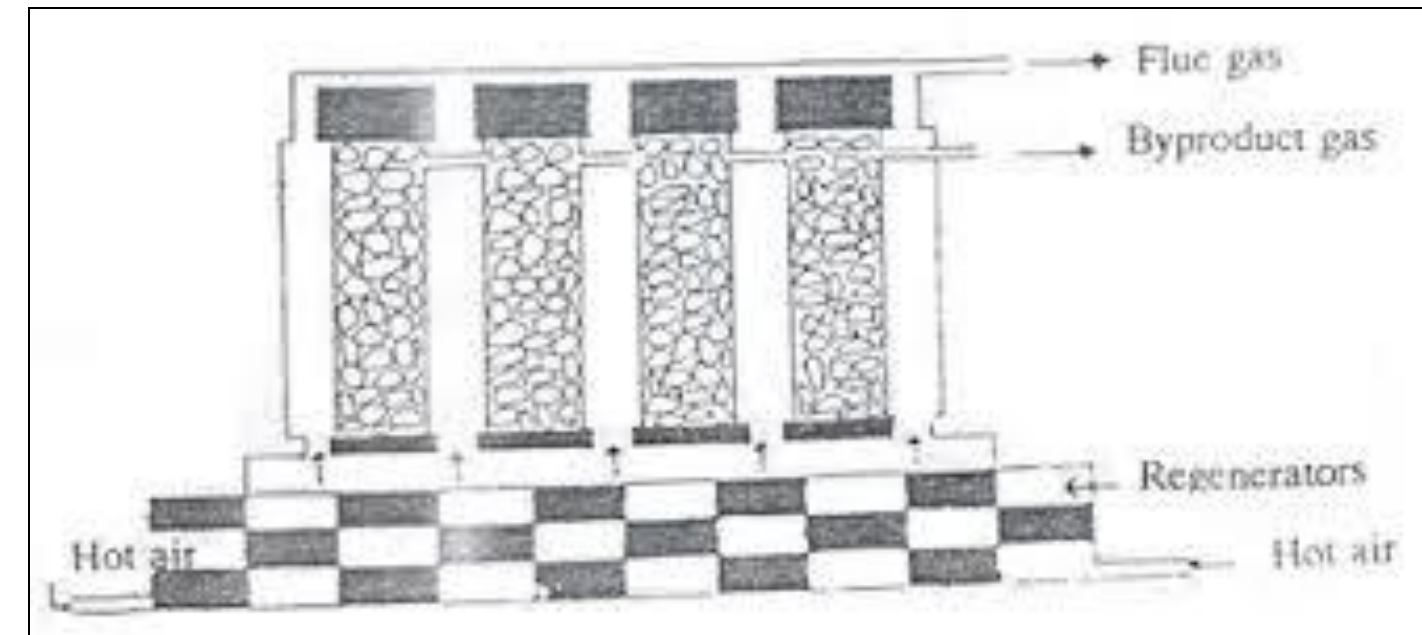
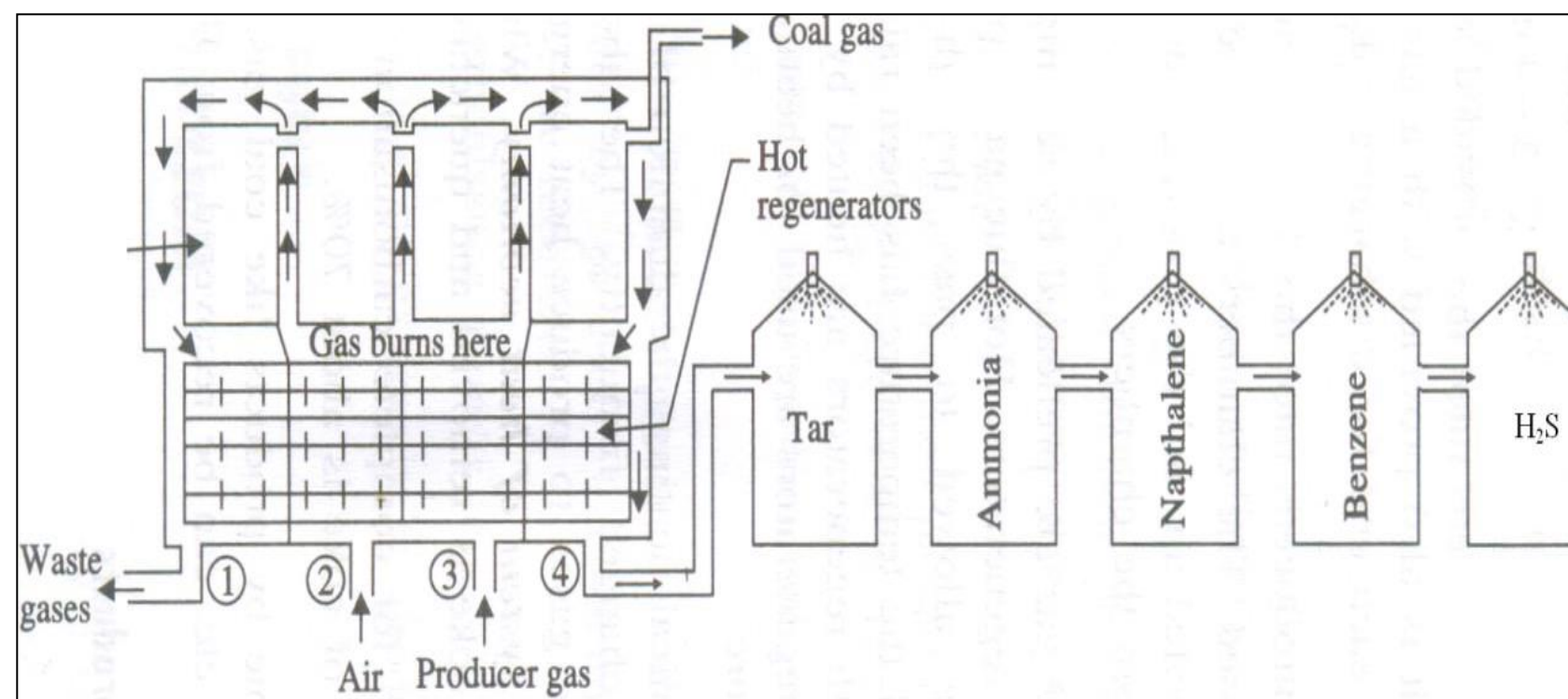




# CARBONIZATION PROCESS



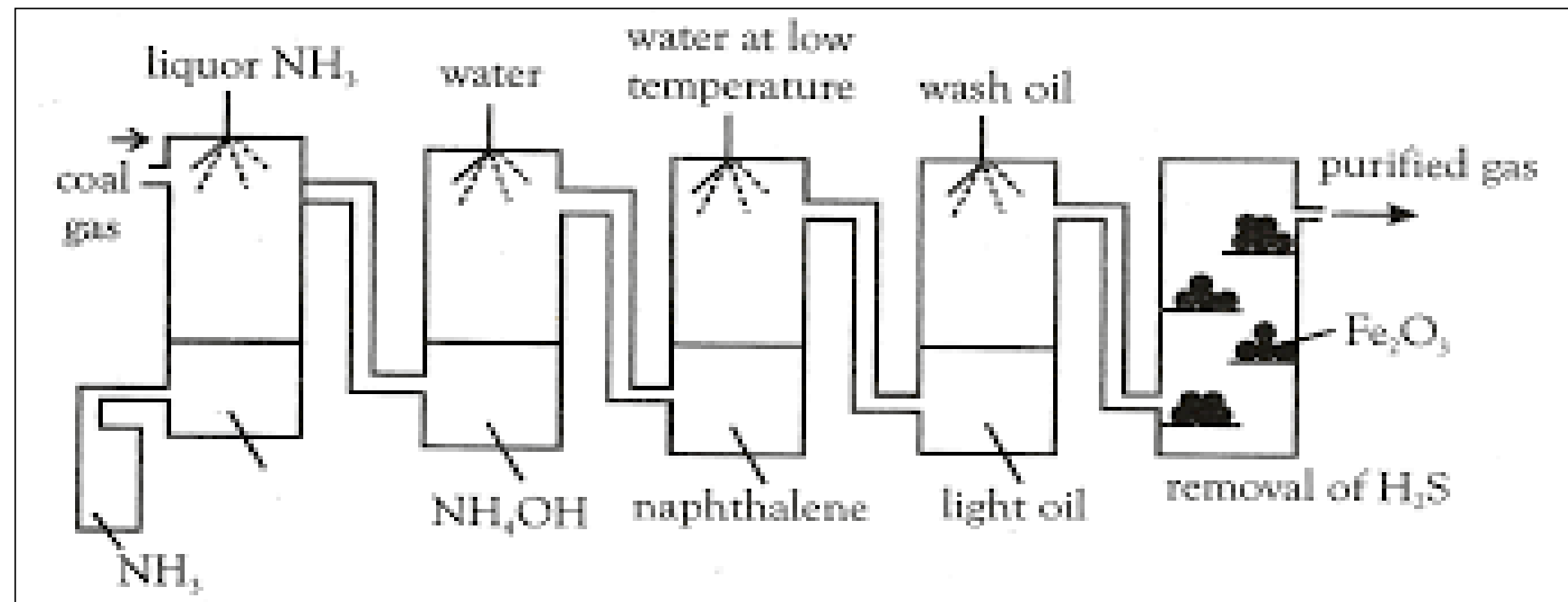
- For economical heating, the direction of inlet gases & flue gases are changed frequently.
- The cycle goes on and the heating is continued until all the volatile matter has escaped.
- It takes nearly 18 -20 hours for carbonization of a charge.
- When the carbonization is over, the red hot coke is pushed out into truck by a massive ram.
- It is then quenched by spraying water (wet quenching). The yield of coke is about 70 %.





# RECOVERY OF BY-PRODUCTS

- (i) **Recovery of Tar:** The liquor ammonia is sprayed to collect tar & dust
- (ii) **Recovery of Ammonia:** The water is sprayed to collect  $\text{NH}_3$  as  $\text{NH}_4\text{OH}$
- (iii) **Recovery of Naphthalene:** The cold water is sprayed, naphthalene gets condensed.
- (iv) **Recovery of Benzene:** Petroleum is sprayed, benzene gets condensed to liquid.
- (v) **Recovery of  $\text{H}_2\text{S}$  :** The remaining gases are passed to purifier packed with moist  $\text{Fe}_2\text{O}_3$ ,  $\text{H}_2\text{S}$  is retained.

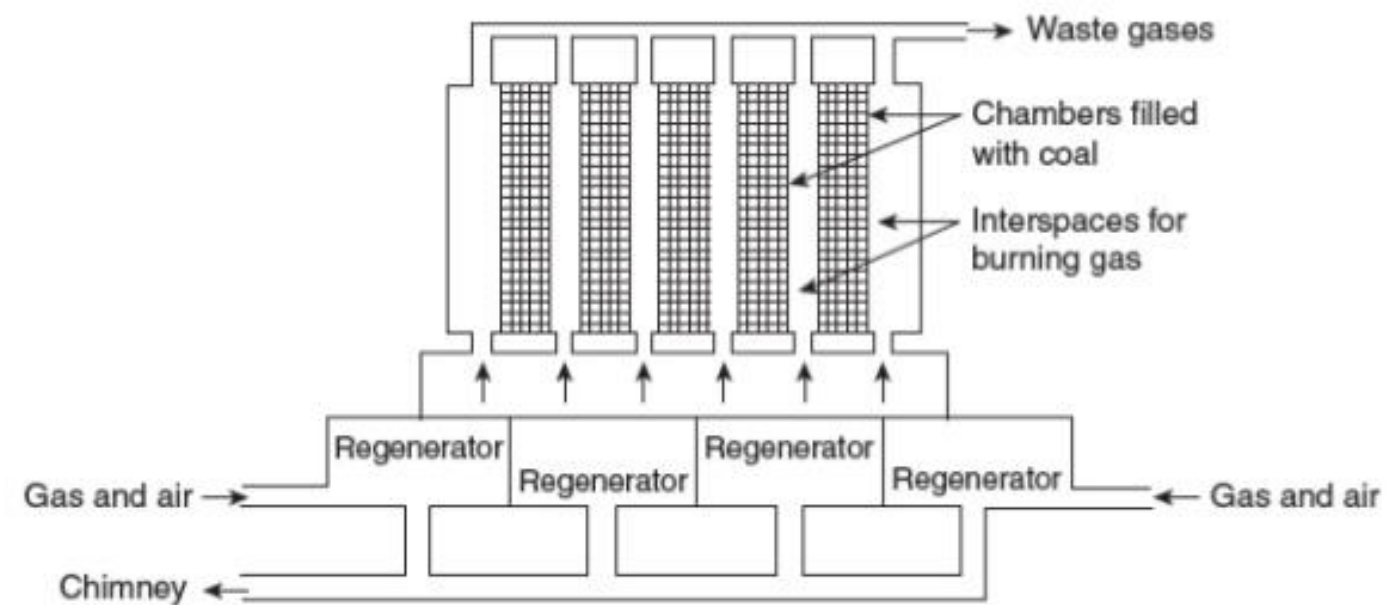




# ADVANTAGES



*Otto-Hoffmann or Byproduct Oven*



*Engineering Chemistry (revised edition)*

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**WILEY**

## Advantages of this method

- Valuable by products are recovered.
- It requires less time.
- Heating is done externally by producer gas.
- Flue gas produced during carbonization is also used to preheat the coal.





# ASSESSMENT



- 1. Draw the Otto -Haffmann Oven to recover Valuable by products**
- 2. List the recovered by products from the carbonization process**



# SUMMARY



# REFERENCES



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2. Wiley, “Engineering Chemistry”, John Wiley & Sons. InC, USA.
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4. R. Sivakumar andNSivakumar, “Engineering Chemistry” Tata McGraw-Hill.Pub.Co.Ltd. New Delhi.2009.

**THANK YOU**