Value Added Products from Gasification

Activated Carbon

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- Activated carbon has the strongest physical adsorption forces or th highest volume of adsorbing porosity of any material known to man.
- Very high surface area 500 – 1500 m2/g.
- Highly porous structure – Consists of micro-pores and macro-pores.

Properties

- Surface area
  - Determines the adsorption capacity.
  - Usually found by the adsorption of nitrogen.
  - Depends on the micro-pores
- Physical properties – density, hardness, particle size

Other Indicators to Adsorbing Properties

- Iodine number —Adsorption of iodine from solution.
  - Represented as milligram of iodine adsorbed per gram of carbon
  - The iodine number is nearly equal to the surface area in m2/g
- Decolorizing Power
  - Adsorption of dyes from solution —Methylene blue number
- Adsorption capacity —adsorption of organic vapors from air stream
  - Carbon tetra chloride

    - Benzene
- Oil retention and filterability
- Hardness number —Percentage retained in a sieve of given mesh size after shaking the material along with steel balls for a specific time.

Source

- Biomass – Wood, coconut shell, etc
- Charcoal made thermally driving away volatiles
- Charcoal activated by steam or by acid wash

Byproduct from Gasification

- With coconut or wood chips as feed stock, activated charcoal can be extracted from the reactor at varying rates.
- The yield of charcoal range from 4 % to 20%
- Iodine number obtained range from 200 – 800. Larger iodine number obtained with lower yield.
- Charcoal can be further activated with steam or nitrogen

Advantages of obtaining Activated carbon from gasifier

- Utilization of energy of volatiles
- High quality charcoal
- Environment friendly. Does not produce pollutants as in the conventional process.
- Improves the economics of gasifier operation.
- Control over the quality of char generated.

Steam Activation of Charcoal

- Pass steam the a bed of charcoal at 600-800C for 8 – 12 minutes
- Micro pores are opened by reaction of steam with carbon

- Iodine number increases with time initially, but decreases subsequently due to coalition of micro pores
- Carbon is consumed because of reaction of H_2O with carbon
- Iodine number in excess of 1000 can be obtained

Activation using Inert Gases

- Activation can be achieved by exposing carbon to inert gases at high temperature.
- Loss of carbon during the activation is negligible
- No tendency for reduction in iodine number with time of exposure
- Further work in progress for activation with combustion products.

Iodine number obtained with nitrogen at 850° C