AIR BLOWING PROCESS FOR MANUFACTURE OF BITUMEN

AIR BLOWING

- This process gives the refiner a wide flexibility to produce bitumen which cannot be produced otherwise.

- Vacuum residues from particular crude oils meet the specification requirements for **penetration bitumens** or **viscosity graded asphalts.**

- For harder penetration bitumens however further processing is needed to obtain desirable properties for road or industrial uses. This is achieved by air blowing.

- In this process the aromatics and polar aromatics in the feed flux are condensed to form higher molecular weight species in the air-blown bitumen.

- The process doubles the asphaltenes levels while the levels of aromatics are reduced.

- **Limited air blowing** is only needed where it is necessary to produce penetration bitumens or viscosity graded asphalts from vacuum residue.

- It is possible to blow the vacuum to desired penetration range or to blow the vacuum residue to lower penetration value than needed.

- The latter can then be blended with the vacuum residue in a varying proportion to provide a range of bitumens.

- This second alternative can be referred to as over ***blowing and back blowing, semi blowing or partial blowing as only a part of the vacuum residue*** is blown.

•Oxidized bitumens, roofing asphalts or air-blown asphalts are produced using extended air blowing of vacuum residues or mixtures of vacuum residues and materials such as atmospheric residues or waxy distillates. Even, lubricating oil extracts are used to a limited extent.

•Catalysts in small concentrations such as ferric chloride (0-1%) and phosphorus pentaoxide (0-4%) are used to speed the reaction or modify the properties of the resultant bitumens.(***catalytic air blown bitumens***)

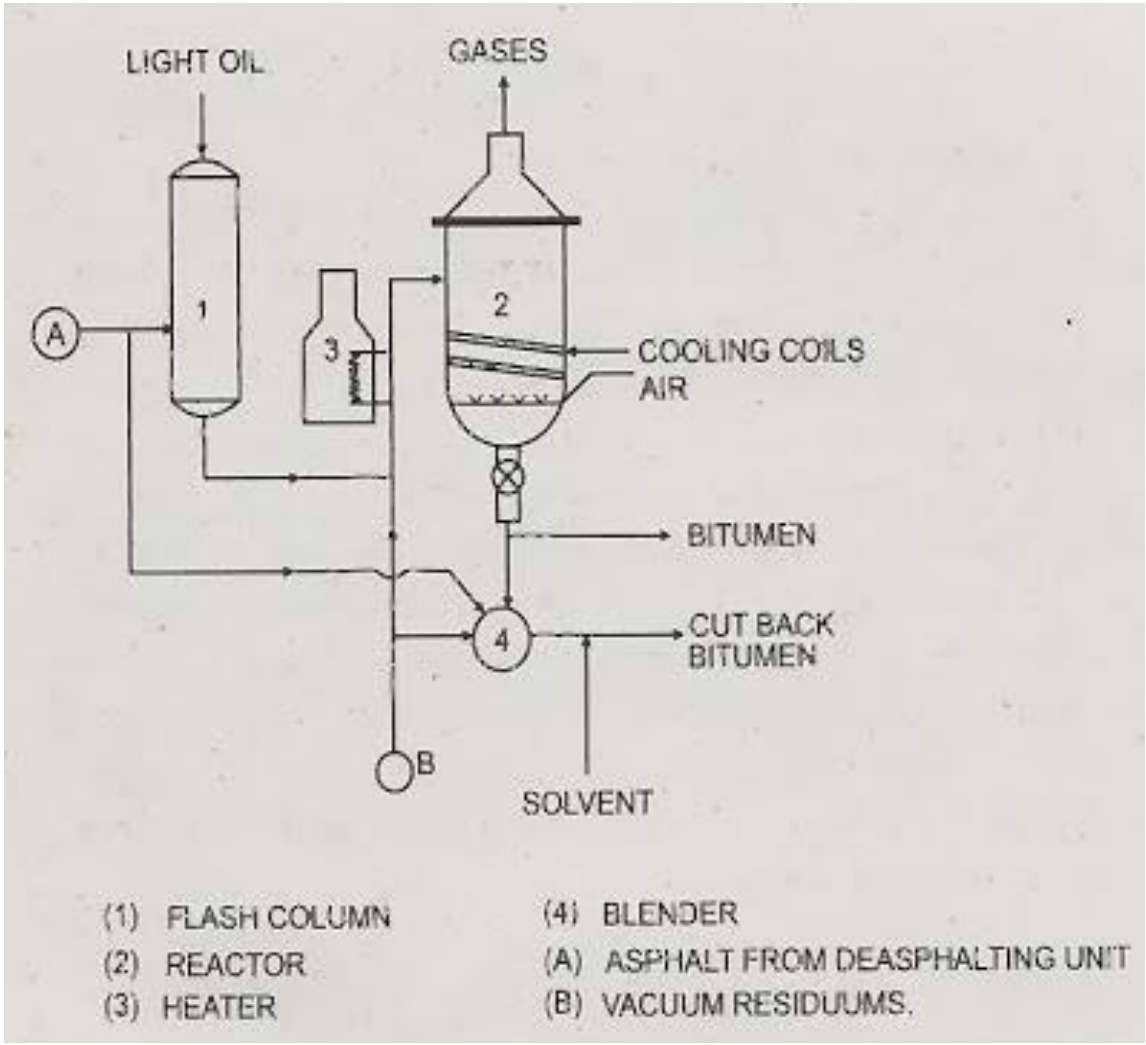
•The blowing processes give rise to noxious fumes. These are mixtures of sulphur compounds, light oils and steam. They are eliminated by water scrubbing and incinerated in a fume disposal furnace.

AIR BLOWING PROCESS

- ***Air blowing is a process in which hot liquid asphalt is contacted with air***. This process dehydrogenates the residues, resulting in oxidation and condensation polymerization, increases the overall molecular weight.

- This process provides products with properties that are unattainable by other means. These properties have made bitumen adaptable to roofing, waterproofing, adhesive and sealing applications.

- The asphalt is hardened as a result of air blowing and the properties of hard air blown bitumen are less susceptible to change with varying temperature and those of comparable asphalts from other processes.



Batch process for bitumen manufacture

Batch process for manufacture of bitumen:

- Air blowing of bitumen is mostly done in batch units.

- In this operation, asphalts from various sources are mixed and heated to a temperature of 200-210 degrees and sent to a reactor.

- The reactor may be horizontal or vertical type, usually made of mild steel , of a capacity to hold 1000 tons of charge stock .

- These reactors are fitted with air distributors at the bottom and also cooling and heating coils.

- During oxidation the temperature may increase rapidly, hence as a precautionary measure provision for cooling is made available.

- The reactor should be maintained at a temp. of 240 to 300 degrees.

•Blowing time lasts for 10 to 14 hours depending upon the required consistency of bitumen.

•Gases are allowed to escape into refinery flare up or combustion system after being stripped with water.

•The product, air blown bitumen is obtained from the bottom of the reactor.

PROCESS VARIABLES:

EFFLUX OF FLUX SOURCE OR COMPOSITION:

Flux source has significant effect on the following dependent variables:

- Softening point penetration relationship
- Composition of blown bitumen
- Rate of reaction
- Heat of reaction per degree of softening point rise.
- Process losses

The **composition** of the blown bitumen is known to change substantially during air blowing.

Asphaltenes always increase significantly while naphthene aromatics always decrease.

The process losses consist of:

•Condensable oils which are derived from the front end distillate fractions naturally present in the flux.

•Water which is the reaction product when flux hydrocarbons are hydrogenated.

•Non condensables consisting of gaseous reaction products.

EFFFLUX OF FLUX CONSISTENCY

Lower flux or consistency or viscosity yields blown bitumen with higher penetrations at the same softening point level. Flux consistency has only a slight effect on the other dependent variables.

EFFECT OF BLOWING TEMPERATURES

•Slightly higher penetration is observed when lower temperature are used.

•More asphaltenes are made when using higher blowing temperature.

•Reaction rate becomes greater as the temperature is increased.

•Product losses are always higher at high temperature undoubtedly due to distillation effect.

AIR RATE OR DEGREE OF DISPERSION

The higher the air rates and better degree of dispersion significantly increase the rate of reaction.

CATALYSTS

Catalysts significantly increase the penetration with **ferric chloride** being more effective than phosphorous pentaoxide.

When ferric chloride is added to the air blowing step the cyclo saturates are dehydrogenated.

TYPICAL OPERATING CONDITIONS:

Temperature °C	240-300
Air rate $m^3/h/kg$	0.025-0.050

Thanks