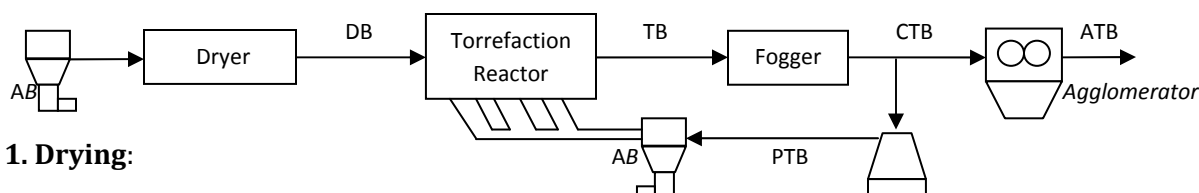


TORREFACTION-ACTOF

Torrefaction is a thermo-chemical treatment method in the first place earmarked by an operating temperature within the range of 392F to 572F. It is carried out under atmospheric conditions and in the presence of minimal amount of oxygen in order to avoid spontaneous combustion. The process is characterized by longer heating rates and residence time than conventional drying processes. During the process, the biomass partly decomposes giving off various types of volatiles. The final product is the remaining solid, which is often referred to as torrefied biomass or char. Our brand name is ACTOF.

Torrefaction-ACTOF (Ablazing Clean Torrefied Organic Fuel) Process:

The Torrefaction process consists basically of 3 stages as shown:



1. Drying:

The wood chips which are less than 1/8 inch thickness and around 40% moisture content are fed into the dryer. The dryer is a direct, convection type Z8 Rotary Dryer which dries the material down to 2% moisture content. The heat for the dryer is supplied by the ACTOF Burner which is a pulverized - suspension wood fired burner. The heat transfer within the dryer is convective in nature. The hot gases from the burner are induced into the dryer by means of an induced draft fan. This along with the dryer design causes turbulence within the dryer leading to efficient and uniform drying of wood chips. The wood chips coming out of the dryer are at 2% moisture content and around 120F. These wood chips are then conveyed pneumatically into the Torrefaction Reactor.

2. Torrefaction:

The wood chips from the dryer are metered into the torrefaction reactor. The torrefaction reactor consists of a rotary drum with a small angle of positive inclination. The drum rotates within an insulated shell through which the hot gases flow by means of an induced draft fan. Torrefaction temperature is maintained within the torrefaction reactor. The heat energy transfer in this case is conductive in nature. There is no air flowing inside the reactor which ensures an oxygen starved environment. In case of rising levels of oxygen within the reactor, it can be displaced by means of nitrogen purging. Due to the conditions present within the torrefaction reactor, the biomass undergoes torrefaction as it completes its journey across the reactor. In the process of torrefaction, there is a small amount of mass loss owing to the VOC's released. The VOC's given off are conveyed back to the ACTOF Burner where they are incinerated. The hot gases providing heat to the reactor by conduction is conveyed to the dryer thus minimizing heat loss and improving the process efficiency. The temperature of torrefied biomass is too high to be exposed to atmosphere as it can result in spontaneous combustion and therefore it has to be transferred to the last stage which is the Cooling Stage.

3. Cooling:

The hot torrefied biomass is transferred into the cooler. The cooler consists is a water fogging equipment where a mist of water comes in contact with the hot torrefied biomass. As the hot torrefied biomass moves across the cooler, heat transfer takes place between the water and torrefied biomass by means of convection. Water absorbs the heat of torrefied biomass and evaporates. Thus, the torrefied biomass is cooled to a temperature much below the spontaneous combustion temperature. The amount of water sprayed is equal to the amount of water needed to lower the temperature of torrefied biomass below its spontaneous combustion temperature. The water needed for fogging need not be potable water and as such can be obtained from any water body, for example, river, lake, pond, well, etc. The water is first filtered to remove any particulates before being pumped through the fogger. The exhaust from the cooler consists only of water vapor.

Hammermill and Agglomeration:

A part of the cooled torrefied biomass is now transferred to the hammermill where it is pulverized after which it is conveyed into the burners as fuel. The remainder undergoes agglomeration before being transported to the respective stockpiles.

Properties of Torrefied Biomass:

1. Torrefied Biomass is hydrophobic in nature, meaning the material does not regain moisture in storage and therefore unlike wood or coal, it is stable with well defined composition.
2. Lower moisture content and higher calorific value compared to biomass.
3. Less emissions during combustion.
4. Higher density and similar mechanical strength compared to initial biomass.
5. Suitable for various applications as fuel in combustion and gasification, steel industries, etc.

Torrefied Biomass as a substitute for coal:

1. Torrefied wood can be blended with coal for co-firing in coal fired power plants, industrial furnaces, etc. with no modification to the existing equipment at the above mentioned facilities.
2. Fuel for domestic cooking stoves. Torrefied Biomass kindles very quickly which makes stove management easier and faster as compared to charcoal.
3. It can also be used as fuel for residential heating.
4. Can be converted into high energy fuel pellets/briquettes, compacted fireplace logs and barbecue briquettes for commercial and domestic uses. Torrefied wood pellets have superior combustion characteristics than ordinary wood pellets.

5. Since torrefied biomass has uniform characteristics, its behavior is predictable and it provides optimum combustion properties.
6. Because of its very low moisture content (around 2%), the transportation costs are low and act as a high quality fuel.
7. With 30-35% fixed carbon content, torrefied wood has a promising potential as reducer.
8. Torrefied wood has a Hardgrove Grindability Index (HGI) comparable to that of coal.
9. Torrefied wood has large amount of VOC's (65-75%), making it burn better than coal.
10. Torrefied Biomass can be blended with coal and co-fired in a pulverized coal-fired boiler.
11. Torrefied Biomass is highly friable and therefore it can be used for gasification purposes. It also leads to lower horsepower requirements for grinding, pulverizing, etc.

The homogeneity and seasonal regularity of torrefied biomass makes it an appropriate substitute for charcoal.

Abbreviations:

DB – Dried Biomass

TB – Torrefied Biomass

CTB – Cooled Torrefied Biomass

ATB – Agglomerated Torrefied Biomass

PTB – Pulverized Torrefied Biomass

AB – ACTOF Burner