

Earth Care Products, Inc.

Dust Explosions and Fire: Torrefied vs. Non-Torrefied Biomass

Nature's biological decomposition of organic biomass and wood releases volatile organic compounds (VOCs) into holding or storage hoppers and bins or the atmosphere during open storage.

Most processed, dried biomass/wood particles put into storage with a moisture content of 15% or more can start to heat. The surrounding drier biomass insulates the heating area, supporting a rise in its temperature up to auto-ignition and combustion with oxygen levels in the biomass/wood. As the liberated VOCs vent into the storage unit, their containment poses a condition that is conducive to fire or explosion. Some believe that dust suspended in storage units is the cause of fires or explosions. However, most often biological composting of organic materials provides the chemistry (fuel) and auto-ignition temperature resulting in fires and explosions.

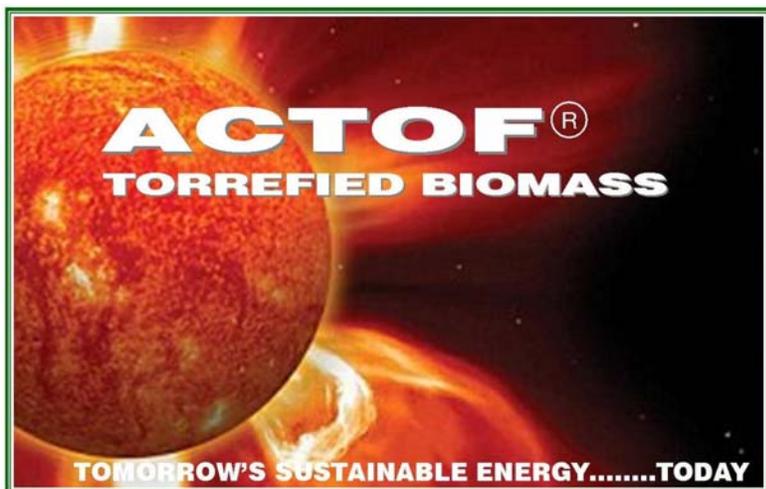
When the same organic biomass/wood material has been torrefied, it results in the liberation of light VOCs. This prevents the organic materials from further volatilizing and heating in storage, even upon application of moisture. With no composting heat for ignition and no VOCs in the atmosphere, the potential for fire or explosion of torrefied biomass is greatly reduced in storage or handling by mechanical conveyors of torrefied biomass. As the volatile content becomes lower during torrefaction, cell structures in the biomass shrink, seal up, and become hydrophobic. As the volatile content in biomass reduces, the concentration of fixed carbon content in the biomass increases. The lower the volatile content of biomass, higher is the temperature needed for auto-ignition due to its increased fixed carbon content.

Examples: Woody biomass with 80-85% volatile content and 10-12% fixed carbon content has an auto-ignition temperature of 575°F. Torrefied biomass with 60-65% volatile content and 30-32% fixed carbon content has an auto-ignition temperature of 600-620°F. Carbonized biomass with 10-12% volatile content and 80-85% fixed carbon content has an auto-ignition temperature of 1,000-1,100°F

Torrefied biomass dust generated from conveying and cascading into storage poses a fire and explosion risk if dust-to-air ratios become a perfect formula and the explosive concentration of dust and air is exposed to a spark or any other ignition source. Any mechanical or electrical thermal heat source that provides temperature above auto-ignition can start a dust fire or explosion. It is believed that quality torrefied biomass will permit outside storage in the same manner as coal. If stored in hoppers, bins, or tanks, torrefied product significantly reduces biological decomposition, therefore greatly reducing the risk of ignition.

The hydrophobic nature of our torrefied biomass/wood product, ACTOF® , decreases the contact angle hysteresis between the water molecule and ACTOF® surface. This reduces the degree of percolation of water into an ACTOF® storage pile. As a result, an ACTOF® pile stored in the open and subjected to rain will be wetted only a few inches into the pile. This will also depend on the quantity and duration of rain, plus undulation of the ACTOF® stockpile.

Although ACTOF® particles are hydrophobic, they will adsorb moisture. The surface of the particles will be wetted from the moisture in the air. This will be seen during times of rain and days with high relative humidity. However, the cells in ACTOF® particles will not absorb any moisture. As the relative humidity of ambient air drops, the moisture from ACTOF® particles will evaporate into ambient air. This process/activity is clearly observed when morning dew evaporates. Water vapor similar to fog can be seen emanating from the layer of ACTOF® exposed to atmosphere. (See pictures attached in ECP Publication E326.)



“Commercializing the art of torrefying biomass”