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Explosion risks on biomass materials: how to work with particle size

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The Oxford dictionary defines biomass as all “organic matter used as a fuel, especially in a power station for the generation of electricity”. This broad term includes solid substances from wood to waste: several materials with diverse characteristics that are currently grouped together. However, many properties of these solid substances depend on characteristics as particle shape, size or mechanic properties, which affect the bulk properties of the materials and their relationship to processes such as flow, compaction or fluidisation.
If we focus on the treatment of these materials, safety should be one of the first terms that come to our mind. Making a safe working environment is essential and requires an enormous investment. One of the main risks observed in this type of plants is the fire and explosion risk. Biomass materials are easily dispersible and highly flammable, so the rate of incidents and accidents that these facilities present is higher than many others. In order to make this process easier, the National Fire Protection Energy developed the Standard 664 for the prevention of fires and explosions in wood processing and woodworking facilities. It is important to notice that this standard covers several biomass, as it defines wood as “the cellulosic material derived from trees, and other cellulosic materials including, but not limited to, wheat straw, flax, bagasse, coconut shell, corn stalks, hemp, rice hulls, and paper or other cellulosic fibre used as a substitute or additive to wood”.
The measurements and requirements stablished in this standard are based on the median particle size of the materials to distinguish between materials with a potential fire and explosion risk from those without it. This consideration is based on the previous knowledge on coal particulates, which proved in several occasions that the diameter of the almost-rounded particulates heavily influences the explosion and self-ignition risks associated with these materials. For these materials, the terms d10, d50 and d90 have been widely used, describing the diameter where 10, 50 or 90% of the material’s mass is comprised of particles with a diameter less than this value, respectively.
However, the elongated particle shape of biomass make this assumption inaccurate. One of the dimensions of these particles is comparatively much longer than the other two, making incorrect to assume one unique value for the whole particle.
Once this problem is identified, we face a new one: find a correct concept that fits with these particles and that can be used to define the fire and explosion risks of these materials. Specific surface area, polydispersity, skewness are terms that are now under consideration. Pros and cons are considered, and a discussion is open in order to find the right concept that ensure a safe working space to treat all types of biomass materials.

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